BACHELOR THESIS

Reducing loneliness in hospitalized children aged 5-10 using an online digital game

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Abstract

In this thesis the design process of creating an online digital game to reduce loneliness in hospitalized children without leading to an online game addiction is described. By conducting literature research, the details of loneliness in hospitalized children were analysed as well as children's game preferences and how to decrease the chances of a child getting addicted to an online game. As a conclusion on the literature research, specifications were created that a new digital hospital game needs to adhere to. These requirements were validated through an online questionnaire. Based on the results on the online questionnaire and the literature, the first version of the prototype was created. Through iteration the prototype has been improved and the final version of the prototype has been tested with children. The final prototype of the digital hospital game shows promising results in reducing loneliness while not leading to an online gaming addiction.

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Acronyms

UCLA	University of California Los Angeles
GIT	Graphical Imagery Therapy
MDA Framework	Mechanics, Dynamics, Aesthetics Framework
MDAT Framework	Mechanics, Dynamics, Aesthetics, Therapy Framework
AI	Artificial Intelligence
7D Framework	7-Dimension Framework
PCIAT	Parent-Child Internet Addiction Test
GMS2	Game Maker Studio 2

1. Introduction

When thinking about hospitals, a safe and healing environment comes to mind. However, people who visit hospitals often feel anxious (Pellosmaa, 2020). This feeling is even worse for children, as children are especially susceptible to the stressful experience of visiting the hospital (Coyne, 2006). During hospitalization – when children are not in a familiar environment – children report feeling bored, lonely and scared (Kregting & Chen, 2013; Rokach, 2016; Wilson et al., 2010). When these feelings are not tackled, this may lead to behavioural and psychological difficulties in children (Goslin, 1978).

The loneliness that children experience is caused by a disconnection from both the safe environment of their home as well as a disconnection from their friends and family (Coyne, 2006; Rokach, 2016; Wilson et al., 2010). Loneliness can be described as: “the subjective psychological discomfort people experience when their network of social relationships is significantly deficient in either quality or quantity” (Perlman & Peplau, 1998, p. 571).

There are two types of loneliness: emotional loneliness and social loneliness. Weiss (1974) distinguished these types as follows: social loneliness stems from the absence of a broad group of contacts such as friends or neighbours whereas emotional loneliness stems from the absence of a close emotional attachment such as a partner or best friends. In this paper, the term ‘emotional attachment’ is described as an emotional bond that adds richness and fulfilment to our existence (Bopp et al., 2019). To cope with social or emotional loneliness, a continued contact with friends and family who offer support is needed (Coyne, 2006; Rokach, 2016).

As stated previously, an aspect why children feel lonely is their disconnection from their home environment. Children report disliking the hospital environment because it is a strange environment, they do not know what is about to happen and the hospital environment has inadequate play facilities (Coyne, 2006). According to Barnett & Storm (1981), children in distress use play as a means to get control over a situation, as an outlet for their anxiety. Previous research has shown that play is of importance in the life of a child, as play is the natural world for a child (Adams, 1976; Barnett & Storm, 1981). Brown (2006) summarized the thoughts about play and its values. He observed that play is both an outlet for excessive energy and a way of restoring a child’s energy levels. It is through these functions of play that the world of play can be seen as a complex and context-dependant phenomenon (Brown, 2006; Springate & Foley, 2008; Stetsenko & Ho, 2015). Moreover, play is a function that contributes to the social development of a child and it is related to a child’s mental health (Adams, 1976; Gariépy & Howe, 2003; Springate & Foley, 2008). Therefore, the world of play

may be used in hospital environments, as these environments often cause discomfort in children.

The world of play is a broad phenomenon, which ranges from playing outside with friends to digital games. In the last years, digital games have been on the rise (Grubb, 2019) and the majority of children's non-television screen time is dedicated to digital games (Rideout M.A. et al., 2010). In a study conducted by Antunes et al. (2017), digital games have helped to reduce loneliness among elderly. This is in line with the findings of Hausknecht et al. (2015) who found that digital games increases the social connectedness among elderly. Therefore, the use of digital games may also play a positive role in the reduction of loneliness among children. In addition, research has indicated that digital games positively impacts the children's behaviour, health and development (Stetsenko & Ho, 2015; Straker et al., 2014).

However, an important aspect to keep in mind is that children can also get addicted to digital games. This is a significant concern, as an addiction to digital games can lead to an increased sense of loneliness (Chiu et al., 2004; Fisher, 1994). Therefore, the research question of this paper will be:

"*How can loneliness among hospitalized children aged 5-10 be reduced using an online digital game without leading to an online game addiction?"*

To answer this research question, the following sub research questions need to be answered:

"What causes loneliness among hospitalized children?"

"What are the game preferences of children?"

"What leads children to get addicted to games?"

This research will be conducted on behalf of Ecare Innovatie. Ecare Innovatie is a software and health analytics company with locations in both Enschede and Hengelo. The company focuses on innovating healthcare in accordance with modern societal norms and values. Ecare Innovatie's goal is to improve care provision's quality while also increasing efficiency (*Ecare Innovatie*, 2020).

2. Literature Review

This section covers literature research on loneliness, game addiction and children's game preferences which is required for the creation of an online game that suits hospitalized children best. In addition, several already existing ways of reducing distress in hospitalized children will be analysed in the section state of the art.

2.1 Loneliness

2.1.1 Definition

Loneliness is an unpleasant feeling that most people have experienced in their lives. Loneliness can be described as: "the subjective psychological discomfort people experience when their network of social relationships is significantly deficient in either quality or quantity" (Perlman & Peplau, 1998, p. 571). This definition focuses on the experience of the intensity of loneliness. De Jong Gierveld (1998) described loneliness in the following way:

Loneliness is a situation experienced by the individual as one where there is an unpleasant or inadmissible lack of (quality of) certain relationships. This includes situations in which the number of existing relationships is smaller than is considered desirable or admissible, as well as situations where the intimacy one wishes for has not been realized. Thus, loneliness is seen to involve the manner in which the person perceives, experiences, and evaluates his or her isolation and lack of communication with other people

(De Jong Gierveld, 1998, p. 73-74)

This definition implies a multidimensional phenomenon in which three dimensions can be distinguished. The first dimension refers to the deprivation of social contact, the second dimension focuses on the time perspective (is the loneliness situation changeable and treatable) and the third dimension involves different types of emotional aspects varying from frustration to feelings of shame (De Jong Gierveld, 1998).

Young children (under 10 years old) tend to define loneliness as the experience of feeling alone, isolated and cut off from others (Misailidi et al., 2012), whereas older children (older than 10 years) can differentiate between loneliness and aloneness, lonely being an emotional state of mind and alone being a physical state (Junttila & Vauras, 2009; Misailidi et al., 2012).

2.1.2 Causes

As stated before, children in hospitals report feeling bored, lonely and scared (Kregting & Chen, 2013; Rokach, 2016; Wilson et al., 2010). The cause of loneliness in hospitalized children seems to lie in the disconnection that children experience: children's lives are disrupted and hospitalization causes a disconnection from their home environment as well as from their friends and family (Coyne, 2006; Rokach, 2016; Wilson et al., 2010). Children report missing family routines and contact they used to have with friends (Coyne, 2006).

2.1.3 Consequences

Feelings of loneliness are not only unpleasant for the child experiencing these feelings, but when not tackled these feelings may also lead to behavioural and psychological difficulties in children (Goslin, 1978). When children endure loneliness for a significant period of time, this can have negative outcomes such as depression (Harris et al., 2013; Ladd & Ettekal, 2013; Qualter et al., 2010), poor general health (Harris et al., 2013) and social skill deficits (Jobe-Shields et al., 2011; Qualter et al., 2010; Salo et al., 2020).

2.1.4 Measuring Loneliness

While there are considerate consequences of enduring loneliness for a significant period of time, people will not always admit to feeling lonely. This is due to the negative emotional implications that are related with loneliness (Borys & Perlman, 1985; De Jong Gierveld, 1998; Qualter et al., 2010). Therefore, the use of the term 'loneliness' should not be used in questions (De Jong Gierveld, 1998). Fortunately, there have been developed loneliness-measuring scales without using the term loneliness. The University of California Los Angeles (UCLA) Loneliness Scale (Version 3) consists of 20-items to assess how often someone feels disconnected from others (Russell, 1996). In this scale, 9 items are positively worded (lonely) and 11 items are negatively worded (nonlonely). To these 20 statements, answers can be given by choosing one of the options given by a four-point Likert scale ranging from 1 = never to 4 = always. After answering all items, the scores for each item should be summed together, where higher scores indicate a greater degree of loneliness (Russell, 1996). The complete UCLA Loneliness Scale (Version 3) is added to Appendix A.

2.2 State of the Art

To reduce children's feelings of distress in hospitals, both technological and nontechnological means can be used. In this section, several measures will be explained that have been, or are currently used in hospital environments.

2.2.1 Teddy Bear Hospital

Bloch & Toker (2008) examined the effects of the **Teddy Bear Hospital**, as shown in figure 1. The Teddy Bear hospital is a simulated hospital to which children can bring their teddy bear. The children act as the parents of their teddy bear and are encouraged to help with medical treatments to their teddy bear, such as listening to the teddy bear's hearts and lungs. According to Bloch & Toker (2008), if children have a painful experience with doctors or hospital workers, children will respond with feelings of fear regarding future examinations in the form of a reduced obeyance with future medical procedures. Because of the pain-free encounter of a hospital environment and medical treatments that the Teddy Bear Hospital brings, children's anxiety about hospitalization can be reduced (Bloch & Toker, 2008).

Figure 1: The Teddy Bear Hospital. Courtesy of Dr. Ran Schweid (Bloch & Toker. 2008, p. 598)

2.2.2 HospiAvontuur

There have also been created digital games for in a hospital environment. Vrancken et al. (2019) created the game **HospiAvontuur**, as shown in figure 2. This game informs children and parents on their upcoming hospital admission. In this game, a cow-character called Hospi Koe takes the child on an adventure. The game starts in a home environment and includes several scenes such as going to the hospital and going to the surgery ward. With this game, the child knows what to expect of the upcoming hospital admission and this reduces anxiety (CM Ziekenfonds, 2020; Vrancken et al., 2019).

Figure 2: HospiAvontuur scene one, the evening before the visit to the hospital (Vrancken et al., 2019, p. 5)

2.2.3 Hospital Hero

Tranquada et al. (2013) created the game **Hospital Hero**, as shown in figure 3. Hospital Hero takes place in a cartoon 3D environment of a hospital. Children must find lost patients and medical supplies. As a child seeks the lost patients and medical supplies, they will be confronted with several characters. Characters may look happy or they may look sad. If children click on the happy characters, these happy characters will give hints as to where to find the lost patients and medical supplies whereas the sad characters do not give hints. The focus on smiling faces was added because of Baldwin's MindHabits game. Baldwin et al. (2009) state that by focusing on positive information, this may lead to a less stressed and a more optimistic frame of mind. Hospital Hero is a game to familiarize children with both the hospital environment and medical supplies and possible types of patients they may encounter during hospitalization. With the use of this game, children's knowledge about emergency rooms and hospital environments increases which results in a decreased sense of anxiety. (Tranquada et al., 2013).

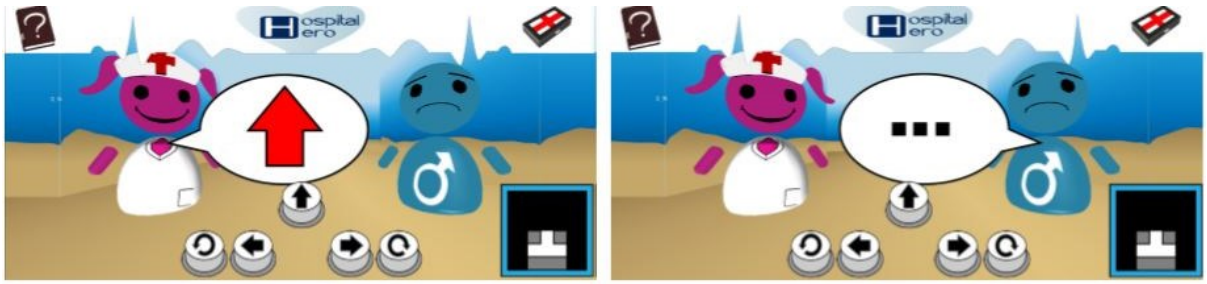

Figure 3: HospitalHero, an encounter with a happy character offering hint as positive feedback (left) and a sad character offering neutral feedback (right) (Tranquada et al., 2013, p. 640)

2.2.4 3D GIT (Graphical Imagery Therapy) Game

Sajjad et al. (2014) created the **3D GIT Game**, as shown in figure 4. This first-person game is visualised to be inside of the child's body. In this game the child must follow the path leading to the destination. Along the path the child must defeat enemy characters, visualised as viruses and tumours, with the use of weapons such as pistols, rifles, and syringes. If an enemy character is killed, the health bar increases. In addition, the health bar increases if medicine and fruits are eaten. With each level, the game gets harder and new weapons unlock. The child can also use soldiers to attack the enemy, the soldiers are visualised as white blood cells. The white blood cells will move along with the tumour in an attempt to kill it. The 3D GIT Game was created via the MDA (Mechanics, Dynamics, Aesthetics) Framework. In this framework, mechanics define the rules of the game. Dynamics define the actions of the game and aesthetics include the level of involvement of the player. In this MDA framework, Sajjad et al. (2014) embedded a psychotherapy procedure that focuses on targeting psychological problems such as anxiety and depression. This MDAT framework, in which the T denotes therapy, can be seen in figure 5 below. Imagery Therapy is added to the aesthetics portion of the game in the form of the following factors (Sajjad et al., 2014):

- **Ability assessment** which includes the patient's performance level and health condition in order to adapt the game to the patient's needs
- **Variability** which keeps the game engaging in order to motivate children to fight the enemy
- **Difficulty adaption** which keeps the game challenging by improving the Artificial Intelligence's (AI) behaviour as the game gets harder with each level

So, children must fight the in-game brain tumour and its powers with as goal to make the children brave enough to fight their own disease in the real world as well. This way, the game reduces anxiety as well as depression levels in hospitalized children with a brain tumour (Sajjad et al., 2014)

Figure 4: 3D GIT Game, showing a character tumour and other viruses (Sajjad et al., 2014, p. 65)

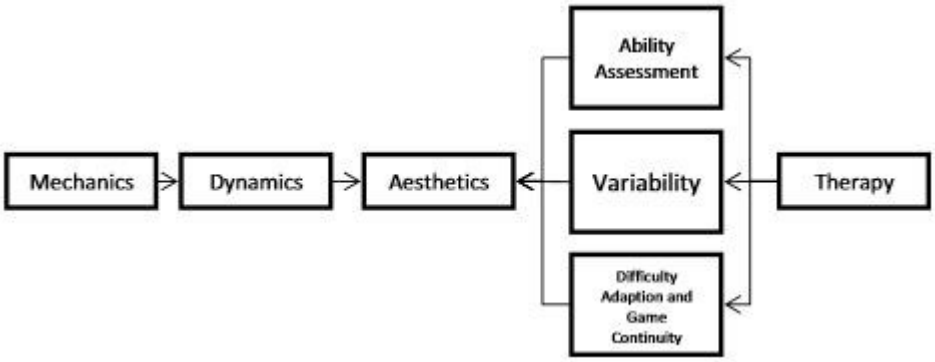

Figure 5: MDAT framework (Sajjad et al., 2014, p. 65)

2.2.5 CliniPup

Verschueren et al. (2019) created **CliniPup**, as shown in figure 6. CliniPup is a game that is designed to be played a week before the scheduled surgery. In this game, a dog takes the child with him on his operation day. This game helps to prepare children for their upcoming surgery and to educate parents on how to deal with pain-management after the surgery. This games helps to reduce pre-operative anxiety for both children and parents (Matthyssens et al., 2020; MindBytes, 2020; Verschueren et al., 2019).

Figure 6: CliniPup, at home before surgery (Verschueren et al., 2019, p. 7)

2.2.6 Statistics

These previously mentioned mono-user digital games have in common that they focus on distracting children. Distraction refers to providing a way of entertainment before or while the child is hospitalized with as goal to reduce the feelings of distress (Jurdi et al., 2018). Children's feelings of distress can be reduced by giving the child a pain-free experience of the hospital. This can vary from familiarizing the child with the hospital environment and medical supplies to familiarizing the child with the upcoming hospital admission. However, these games do not focus on loneliness reduction in hospitalized children.

Jurdi et al. (2018) reviewed game technologies that improve children's hospital experiences to determine gaps for future research. They found that individual games are created significantly more than collaborative games (online, co-located or co-located competitive). These proportions are visualised in figure 7.

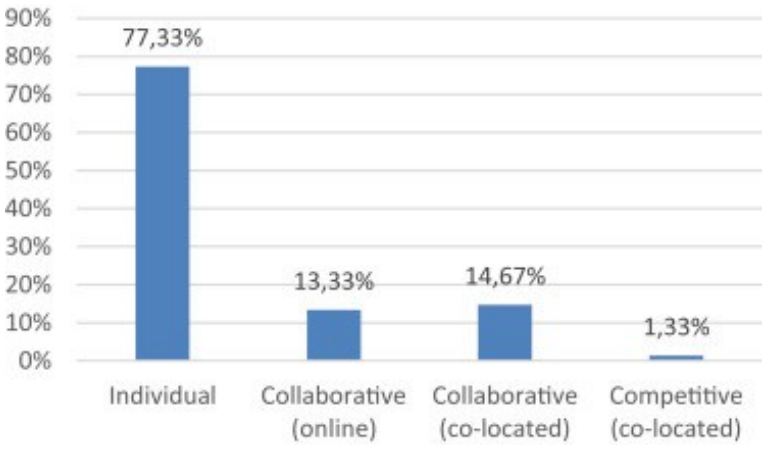

Figure 7: Proportion of digital games created by type (Jurdi et al., 2018, p. 99)

Besides the different type of games, digital games also vary in goals. The goals of the previously mentioned state of the art games are to distract hospitalized children. Other goals include motivation, socialization, education, and emotional coping. This has been visualized in figure 8. The purpose to motivate children includes games to stimulate children to perform some kind of rehabilitation activity (Jurdi et al., 2018). Emotional coping refers to the works that aims to regulate the negative emotions children experience during hospitalization (Jurdi et al., 2018).

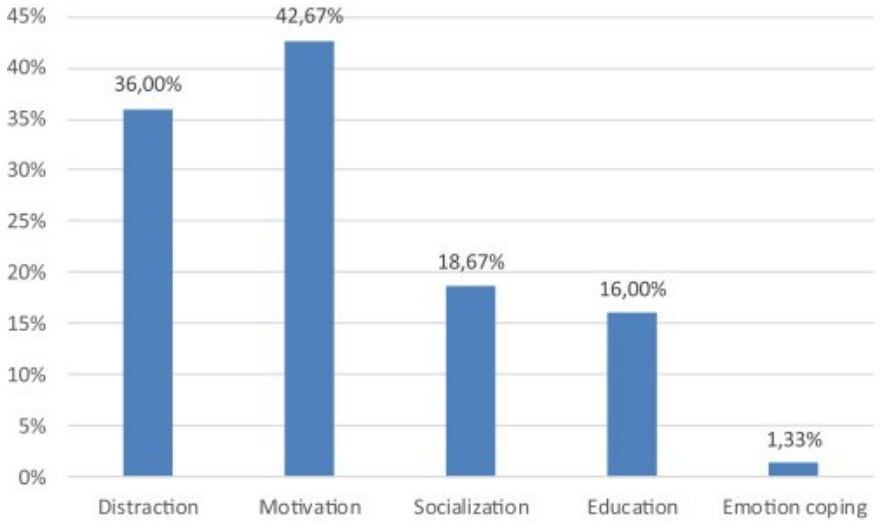

Figure 8: Proportion of different purposes of digital games (Jurdi et al., 2018, p. 98)

From these statistics is becomes clear that there have been developed games with the purpose of socialization as well as games that are collaborative. However, most collaborative games have as purpose to either distract children or to motivate children. The combination of collaboration game with socialization as purpose is rare.

2.2.7 StarBright World

There has been developed an environment which is both collaborative and focuses on socialization. The **StarBright world**, as shown in figure 9, is a virtual environment created for children aged 8-19 with life-threatening diseases, created by Haven & Wiener (2002). In this environment, children can communicate with other hospitalized children via real-time video. Moreover, StarBright world offers information in an age-appropriate way, to increase a child's knowledge on their disease. StarBright world reduces loneliness by providing a sense of connectedness to children (Haven & Wiener, 2002; Lizzy et al., 2012). However, this online environment is neither a game nor created for children aged 5-10.

Figure 9: Starbright world (version 1996) (Lizzy et al., 2012, p. 127)

2.2.8 Conclusion

In conclusion, there have been developed games for in hospital environments. However, these games either focus on reduction of anxiety or are not created for hospitalized children aged 5-10. Future games that are created for hospital environments should focus more on socialization aspects (Jurdi et al., 2018). This can be achieved by creating collaborative gameplay. Collaborative gameplay can be online as well as co-located. The advantage of online gameplay is the ability to play with friends and family who do not need to be in the same location whereas the advantage of co-located gameplay is befriending other hospitalized children or medical workers (Jurdi et al., 2018).

2.3 Game Preferences of Children

To create a game that is suitable for children, their game preferences should first be analysed**.** A model has been designed by de Vette et al. (2018) to get more insight into users for specific game content. In this 7-dimension framework (7D framework), as visualised in figure 10, multiple game characteristic domains are categorised. With this framework, de Vette et al. (2018) assessed children's preferences for game-based healthcare applications.

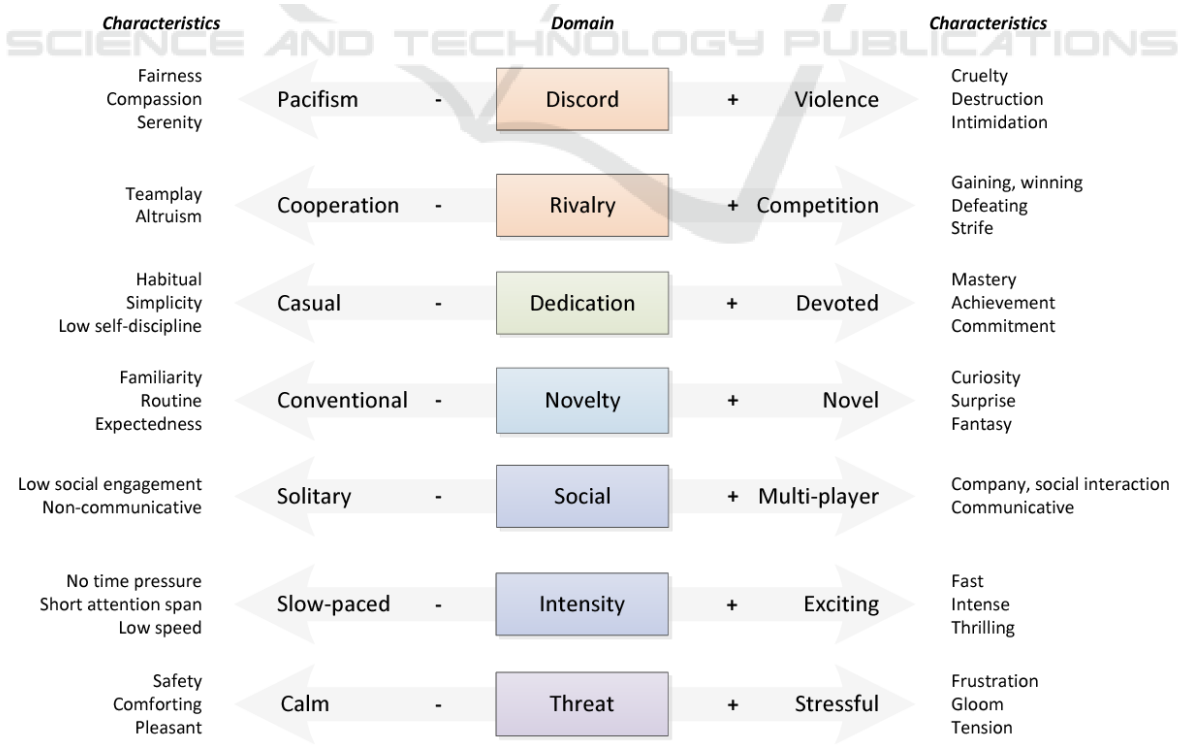

Figure 10: 7D framework (de Vette et al., 2018, p. 423)

According to de Vette et al. (2018), game preferences between boys and girls differ when it comes to these content domains. For example boys prefer digital games that include conflict, violence and threat aspects whereas girls dislike this domain (de Vette et al., 2018; Kinzie & Joseph, 2008). In order to create a game that is suitable for both boys and girls, the following guidelines should be considered.

Firstly, dedication and novelty are important content preferences for both boys and girls (de Vette et al., 2018). Dedication implies that children would like to put effort into the game, for example by adding goals that can be achieved (de Vette et al., 2018). Novelty implies that children like variety in a game. Children want to discover new areas and challenges which keeps children excited instead of playing predictable content such as racing games (de Vette et al., 2018; Kinzie & Joseph, 2008).

Secondly, as stated before boys prefer violent games whereas girls prefer peaceful content. In order to create a game that is suitable for both boys and girls, violent contents should be minimised.

Thirdly, children have indicated to prefer multiplayer games over solitary games (de Vette et al., 2018). However, within these multiplayer games, boys prefer competitive games whereas girls prefer cooperative games. In order to create a game that is suitable for both genders, de Vette et al. (2018) recommend using both options alternately.

For a game that is suitable for boys and girls, the game must include elements that require dedication. Moreover, the game should be novel and violent contents should be minimised. Lastly, the game should offer both cooperative elements as well as competitive elements.

2.4 Gaming Addiction

2.4.1 Definition

Although digital games have a positive impact on a child's health, digital games also bring a disadvantage. Gaming addiction is a significant concern to keep in mind, as all kinds of addiction influence lifestyle and behaviour (Van Rooij et al., 2010). In this thesis the term gaming addiction refers to the obsessive need for playing video games in such a way that it impairs daily life activities. As gaming addiction can lead to an increased sense of loneliness (Chiu et al., 2004; Fisher, 1994), this is an adverse effect for a hospital game.

2.4.2 Measuring Game Addiction

Less than 10 percent of children worldwide are addicted to digital games (Kamenetz, 2019). To measure whether a child suffers from addiction and technology overuse, Young (2017) created the Parent-Child Internet Addiction Test (PCIAT). This test is created to assess signs of behaviour problems in children aged 12-18 that are correlated with an internet addiction (Young, 2017). This scale was adapted into a game addiction questionnaire by Hung et al. (2018). In the 20-item game addiction questionnaire each question correlates with a factor. The factors are salience, mood changes, tolerance, conflict, and time limits which can be seen in Appendix B. The questions must be answered using a 5-point Likert scale ranging from never to always where never = 1 and always = 5. The addiction score is categorised into four categories:

- Normal range: 0-30 score
- Mild: 31:49 score
- Moderate: 50-79 score
- Severe: 80-100 score

The complete game addiction questionnaire can be found in Appendix C (Hung et al., 2018).

2.4.3 Guidelines

While the problem of gaming addiction is recognized, there are currently no governmental guidelines to prevent a gaming addiction in the Western world (Van Rooij et al., 2010). The

most effective way to prevent a gaming addiction in children is parental influence (Apisitwasana et al., 2018; Chiu et al., 2004; Greenfield, 2018; Zorbaz et al., 2015). According to Zorbaz et al. (2015) a discouraging family relation negatively impact a child's risk of a gaming addiction, because a lack of quality social time spent with children can lead to an increased chance of game addiction. This is line with the findings of Chiu et al. (2004), who created a set of guidelines that parents should adhere to in order to decrease the possibility of a child's addiction to video games. These guidelines include:

1. Parents should be involved in the decision of games that children would like to play (Chiu et al., 2004). This way, parents are aware of the game's contents and parents can discuss these contents with their children.
2. Parents should discuss boundaries concerning the amount of time their children are allowed to spend playing digital games (Chiu et al., 2004; Greenfield, 2018), and reward or punish children accordingly if these boundaries are not obeyed (Chiu et al., 2004)
3. Parents should explain the distinction between the 'real world' and the 'game world', and educate their children about the negative effects game addiction can have on a child's behaviour (Chiu et al., 2004).

Provided that parents adhere to these guidelines, a child's knowledge on the consequences of game addiction will grow. Hence, children's self-regulation will increase, which enables them to select games themselves and plan their gaming hours accordingly (Apisitwasana et al., 2018; Greenfield, 2018).

Besides the guidelines that parents can follow in order to decrease the chance of their child getting addicted to video games, game publishers should add a referral service to psychological treatments that helps people to overcome their addiction (Greenfield, 2018; Van Rooij et al., 2010).

2.4.4 Game Limitations

After extensive searching, no additional factors could be found in the literature besides parental influence. In this section, several features are suggested which may help in minimising the chances of digital game addiction. For instance, the game can have constraints that prohibit the child to play after certain hours, to discourage children to play into the night. The game can include time limits, which motivates the children to take breaks every hour. In addition, the game should be able to be saved at any given time. This is to discourage children to negotiate with parents to play one more level. Lastly, the game can include a constraint on a maximum amount of time that can be played daily.

2.5 Literature Review Conclusion

To create a digital game that can be used in hospital environments which has as goal to reduce loneliness, there are a few aspects to keep in mind.

The most important aspect of the new game should be that the game focuses on socialization. To create a game that focuses on socialization, the game must connect people. This can be achieved by creating a multiplayer game. A multiplayer game can imply either co-located multiplayer games, or an online multiplayer gaming environment. Moreover, multiplayer games can either focus on collaboration or competition between players.

The main target group of this research is hospitalized children aged 5-10, this implies the children are already admitted to the hospital. The Teddy Bear Hospital, HospiAvontuur, HospitalHero, 3D GIT Game and CliniPup have indicated that if children are familiarised with the hospital environment, children's feelings of distress decrease. The hospital environment is a broad term which ranges from different wards, medical supplies, medical staff, other patients to medical procedures children will undergo during hospitalization. The new game should therefore also include (some of) these aspects, as the reduction of feelings of distress is contributing to overall wellbeing.

Moreover, the new game should be designed in such a way that new areas can be discovered in which new challenges arise. In addition, in the new game there should be goals to ensure novelty. To ensure the game is enjoyable by both boys and girls, violent content should be minimised, and competition and cooperative parts of the game should be alternated.

With regards to game addiction, the game should include features that minimise the children's chance of getting addicted to the game. This can be achieved by implementing restrictions in the game itself, or by offering information on game addiction.

To validate the requirements, a questionnaire will be sent out to the target group. This will be explained in the next chapter.

3. Method

To validate the requirements that were created in '*2.5 Literature Review Conclusion'*, an online questionnaire was used. With a questionnaire, it is easy to collect data from many people. Because questionnaires allow access to a large number of people, it is useful to get an overview of the user population. Moreover, questionnaires can be easily distributed. However, a drawback from using a questionnaire instead of interviews, is that a questionnaire cannot collect in-depth information. Thus, with an online questionnaire, quantitative information can be gathered which can be used to determine the needs of the target group (Lazar et al., 2017).

3.1 Online Questionnaire

3.1.1 Setup

The questionnaire started with an explanation about the research. In this part, the contact information was stated in case participants had any questions regarding the study. Moreover, it was clearly stated that due to ethical concerns the parents/guardians of a child were in charge of filling in the questionnaire. Additionally, it was clearly stated that participation was voluntary, and participants could withdraw at any given moment. To protect the participant's privacy, personal data of the participant or of the participant's child will not be published. The data has been anonymised using pseudonyms such as participant1. This way, the data can still be used while the participants remain confidential. In appendix D, the complete online questionnaire is added as well as the preview link to the questionnaire. In order to prevent confusion, the questions were presented in Dutch as the respondents are Dutch as well.

3.1.2 Software

For the creation of the questionnaire, Qualtrics was used. Qualtrics is a management platform survey tool in which statistical analysis can be performed. Via Qualtrics, surveys can be build, distributed and analysed (Qualtrics, 2020).

3.1.3 Themes of the Questionnaire

The questionnaire existed of multiple sections. The different sections were separated by different headings. Each section started with an explanation about the topic and the relating questions were grouped in the same section. The questionnaire incorporated the following themes:

- **Introduction.** The questionnaire started with an introduction in which the goals of the study were explained. In this section a question about several platforms was included to get insights in children's platform of preference. In the Appendix D, this section can be found under "Start of Block: Intro".
- **Game preferences part I.** To validate the game preferences as mentioned in "*2.5 Literature Review Conclusion*", there was a section in the online questionnaire regarding game preferences. The first part of the game preferences questions included four questions on the 7D framework created by de Vette et al. (2018) concerning the social aspect (2 questions), threat and intensity. Participants could answer these questions in a 5-options Likert scale where 1 and 5 were opposites. In the Appendix D, this section can be found under "Start of Block: Game Preferences p1".
- **Game preferences part II.** Besides the 7D framework question, this second part of the game preferences included questions about the preference for game genres. Additionally, in case children play games with others, a question was added regarding with whom children play games. This section can be found in Appendix D under "Start of Block: Game Preferences p2"
- **Loneliness.** As previously mentioned, is it possible to measure loneliness using the UCLA scale. However, this scale may be too hard for children to understand. as young children are inclined to describe loneliness as feeling alone, isolated and cut off from others (Misailidi et al., 2012). Therefore, only one question was asked from the UCLA scale, concerning aloneness. Moreover, in this section there was a question concerning social and emotional loneliness. Lastly, this section ended with a statement about whether a game in which a player can play with or against others may help to reduce loneliness in their opinion. This section can be found in Appendix D under "Start of Block: Eenzaamheid"
- **Demographic questions**. The demographic questions were placed in the end of the online questionnaire, as Lazar et al. (2017) stated these are the least interesting

3.2 Covid-19 Limitations

Due to Covid-19, there have been set some regulations by both the University of Twente and the study of Creative Technology. First of all, it was prohibited to contact hospitals or hospital workers. This made it hard to reach the target group (hospitalized children). Consequently, the online questionnaire was distributed to children aged 5-10 who have not necessarily been hospitalized. Second of all, while interviews are used to gather in-depth data, no face to face contact was allowed. In the end of the questionnaire, a question was placed mentioning

whether children have ever been hospitalized and if so, if they would be willing to participate in an online interview.

3.3 Ethics Committee

As this questionnaire concerns children, there was an ethical concern regarding informed consent. Children are incapable of giving informed consent. Therefore, the questionnaire must be filled in by children's parents/guardians. This way, parents/guardians are fully in charge of the answers that are filled in.

This questionnaire is approved by the Ethics department of the EEMCS of the University of Twente.

4. Results

In this chapter the results of the online questionnaire will be interpreted. The questionnaire has been filled in by a total of 8 respondents. All responses are added to Appendix E.

4.1 Demographics

The questionnaire was filled in by the parents of a total of 8 children. One participant has indicated to never play video games. The rest of the questionnaire has been filled in by the parents of 3 girls and 4 boys. The ages of the respondents range from 5 to 10 years old. Only one of the respondents has reported to have been admitted to the hospital but did not want to be contacted for a follow-up interview.

4.2 Introduction

Of the respondents, 87% plays games as is visualized in figure 11 below.

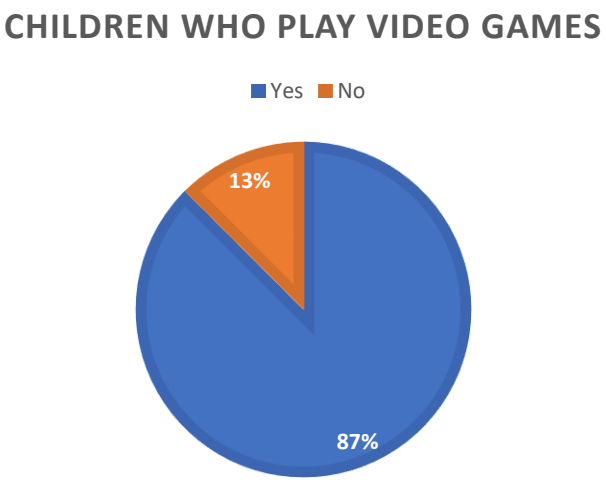

Figure 11: Percentage of children who report to play video games

4.3 Game Preferences

The second section of the questionnaire concerned game preferences. Children could respond per category which of the answers applied to them the most. To provide a clear overview depicting the several categories, the responses have been displayed in boxplots. The responses of the girls are displayed in figure 12 and the boy's responses are shown in figure 13. The total responses are displayed in the boxplot of figure 14.

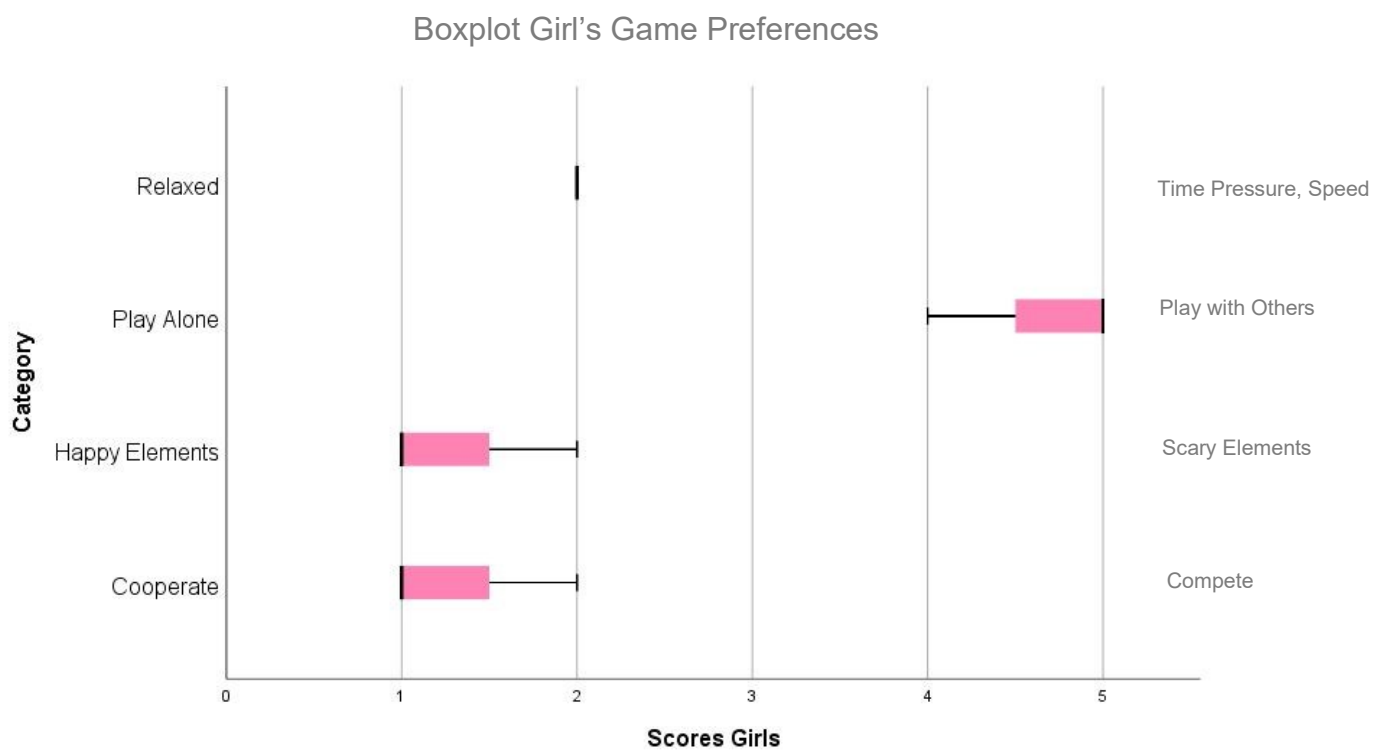

Figure 12: Boxplot girl's game preferences

In figure 12, the girl's boxplot, it can be clearly seen that girls seem to prefer to play with others than to play a game alone. Moreover, girls appear to refer cooperative gameplay rather than compete against each other. In addition, girls appear to prefer happy game elements instead of scary game elements. Lastly, girls seem to prefer a relaxed game above a game which offers pressure in forms of time constraints or speed. In figure 13, the boy's boxplot, it can be clearly seen that, just like girls, boys seem to prefer to play with others rather than playing alone. However, on the contrary to the girl's responses, boys appear to prefer competitive gameplay instead of cooperative gameplay. Concerning relaxed gameplay and the game's elements being happy or scary, boys seem indifferent.

In figure 14, a boxplot of the total results is shown. In this boxplot, it can be clearly seen that both boys and girls seem to prefer to play together rather than to play alone. Moreover, as mentioned before, there is a large difference between cooperative and competitive gameplay. This can be clearly seen in figure 14, where to boxplot concerning cooperative and competitive gameplay is widely spread.

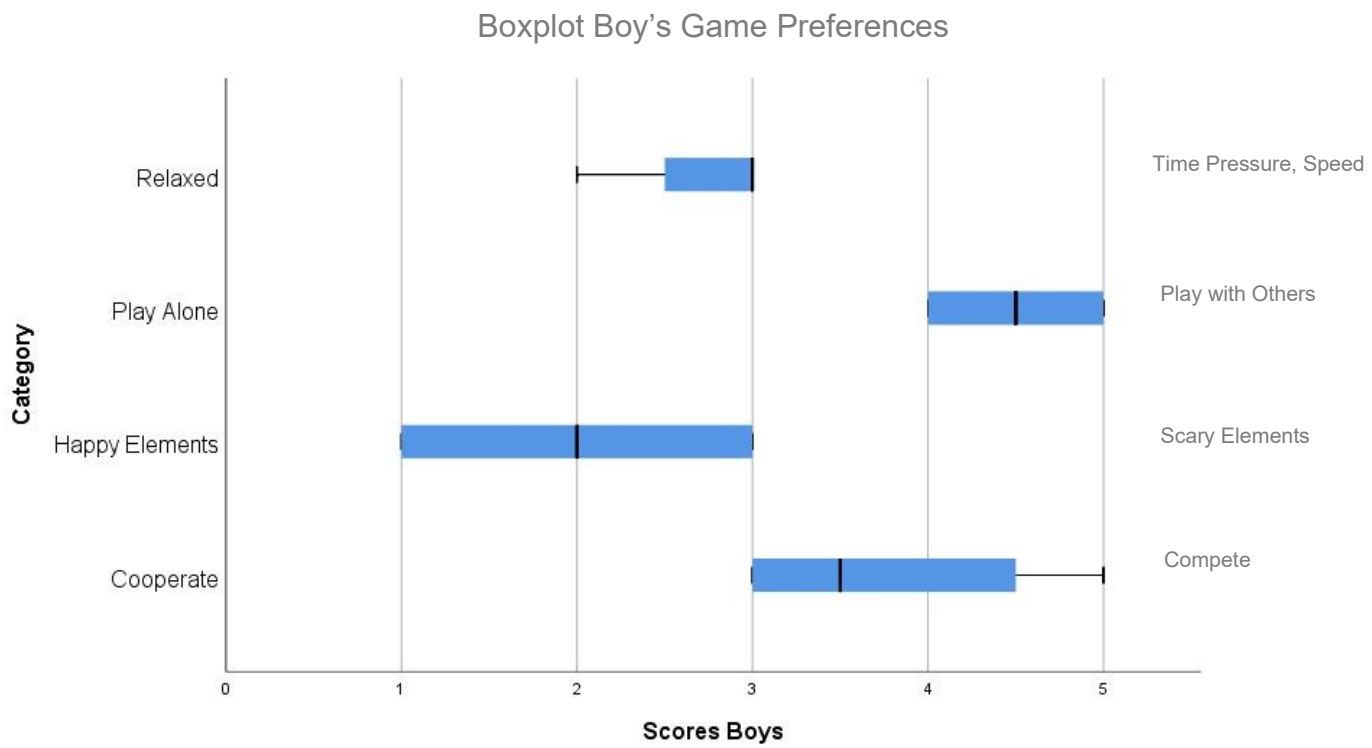

Figure 13: Boxplot boy's game preferences

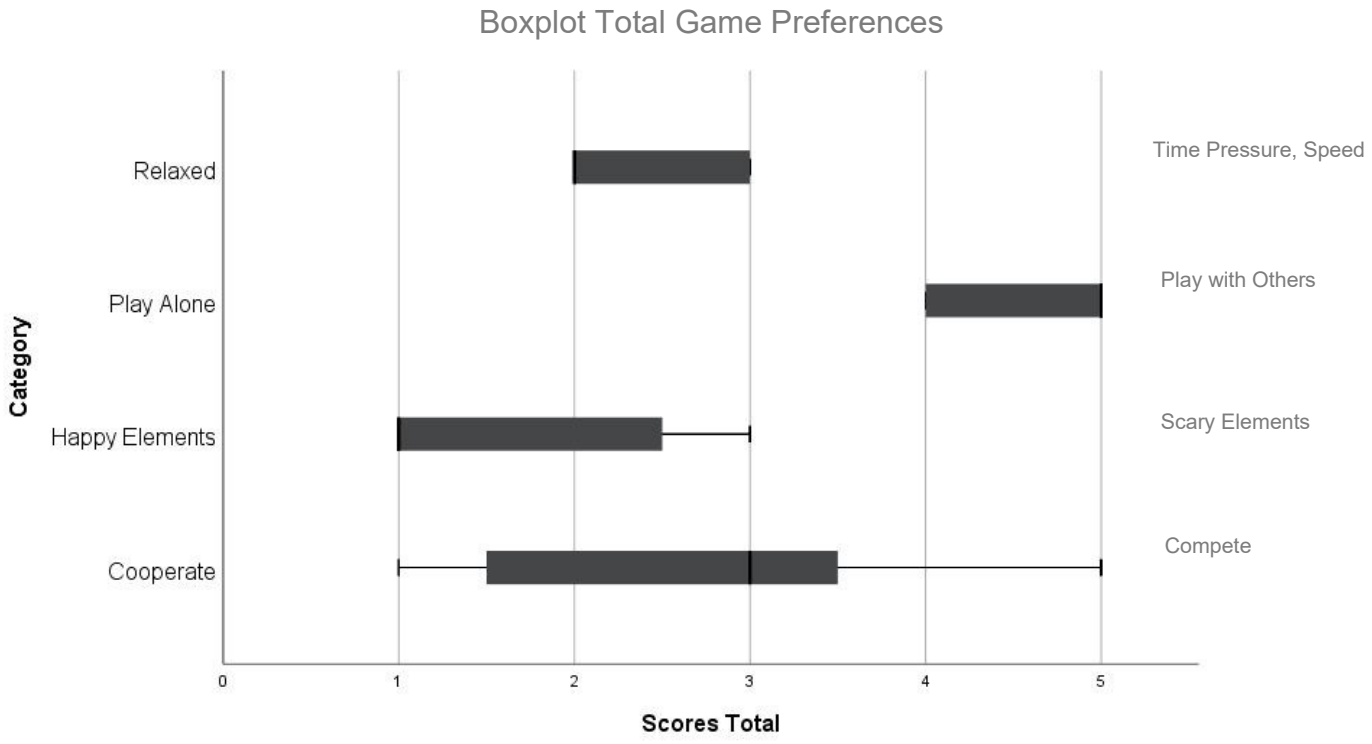

Figure 14: Boxplot total game preferences

Of the respondents, 71% have indicated to play online/internet/application games with others. These results are displayed in figure 15 below. The follow-up question concerning 'others' has been broadly answered. Children report playing with friends from school, friends from the neighbourhood, siblings, parents and in one case even grandparents.

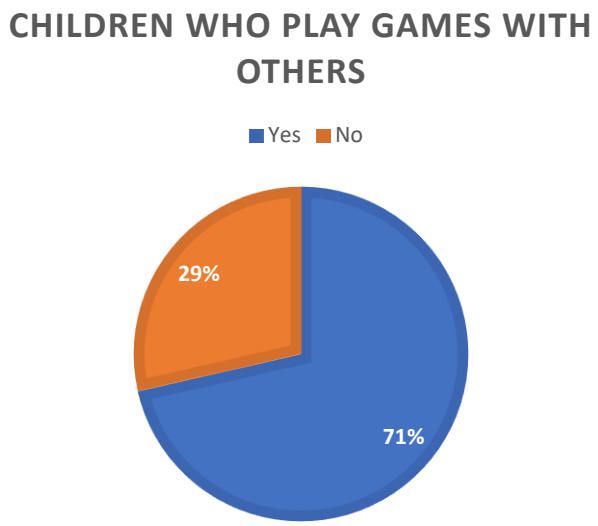

Figure 15: Percentage of children who report playing games with others

Lastly, the game preference section included a question concerning game genres. In this question, children could choose the game genres they preferred the most. Children could choose multiple answers and in total 21 genres have been selected. In figure 16, these results have been displayed.

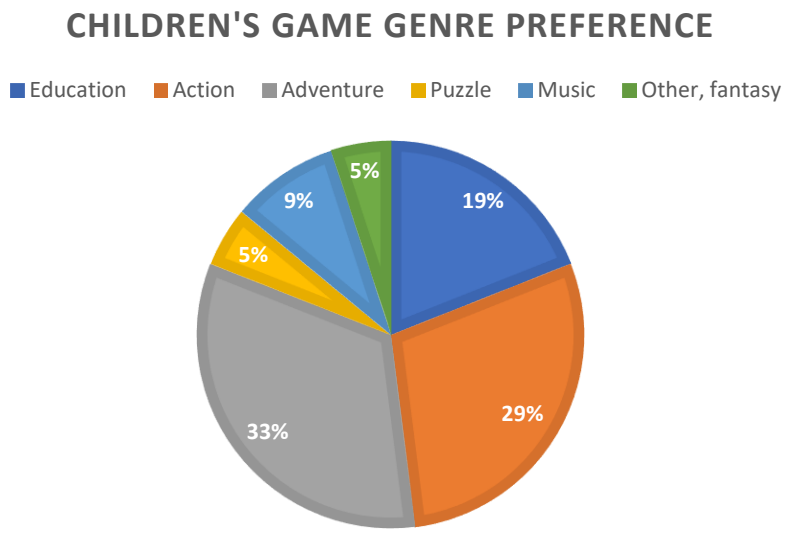

Figure 16: Percentage of each game genre that children report to prefer

These results indicate that the top three preferred game genres amount to over 75% of all genre preferences. The top three includes educational games, adventure games and action games. Besides this top three, children have also indicated to prefer music, puzzle, and fantasy games.

4.4 Loneliness

The questions concerning loneliness were asked in the form of a 5-point Likert Scale. In this scale, 1 = completely disagree, 2 = disagree, 3 = neutral, 4 = agree, 5 = completely agree. The combined responses are displayed in figure 17. Each separate question with corresponding graph is added to Appendix F.

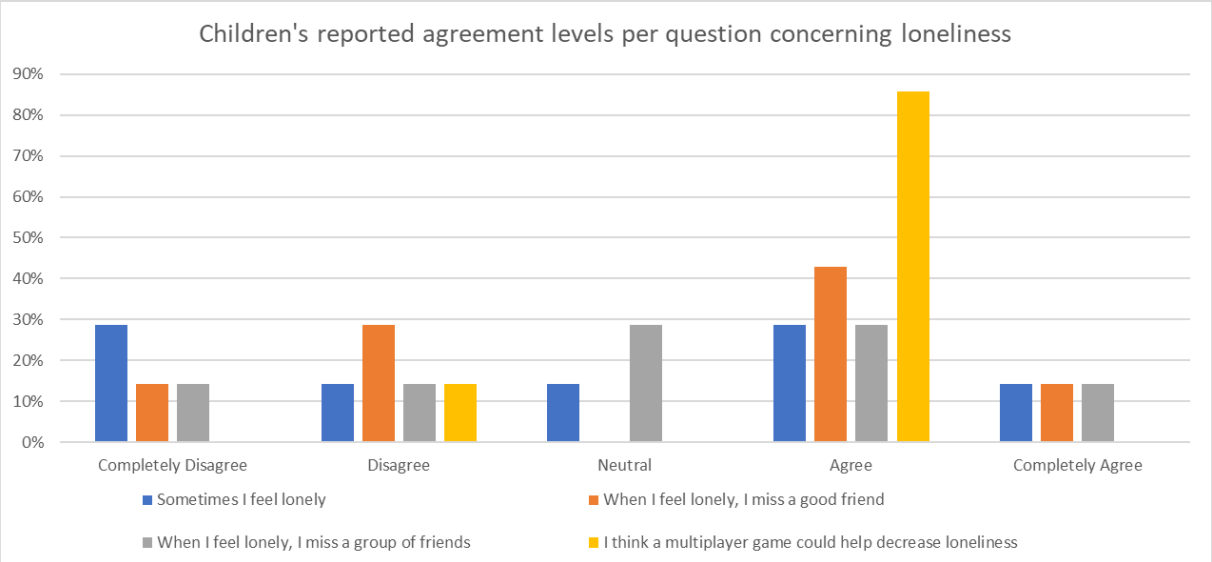

Figure 17: Percentages of children's reported level of agreement per question concerning loneliness

As can be seen in the overview visualized in figure 17, the level of agreement per questions differs per child. Some children report sometimes feeling lonely, while other children report never feeling lonely. Moreover, diverse answers were observed concerning missing a good friend or a group of friends. The graphs of the respondent's individual answers per question can be found in Appendix G. From these graphs there seems to be no correlation between children who feel lonely and the kind of friends they miss. However, the majority of the children (86%) answer in the same fashion, agree, concerning whether game in which people can play with others would be helpful to decrease loneliness.

4.5 Conclusion

The findings of the questionnaire indicate that children prefer multiplayer games over solitary games. Children have indicated to play games with friends from school, friends from the neighbourhood, siblings, and parents. Moreover, children have indicated to think a multiplayer game would be helpful in decreasing loneliness. When it comes to gameplay preferences, there is a large difference between boy's preferences and girl's preferences. The results of the questionnaire indicate that boys prefer to play against one another (competitive gameplay) whereas girls prefer to play together (cooperative gameplay). This is in line with the findings of de Vette et al. (2018). The preferred game genres that children have indicated are adventure (33%), action (29%), and educational (19%).

5. Prototype Realisation

The prototype was realized through iteration. The iteration process is distinguished in several phases. In the first phase, the pre-creation choices will be explained. In the second phase, the basic game will be built. In the third phase some levels will be created according to the feedback received from the online questionnaire and based on the literature research. The prototype was tested and adapted three times which will be explained in '*6. Evaluation and Adapting the Prototype Accordingly'.*

5.1 Phase 1: Pre-Creation

In the first phase of the prototype realisation, the choices that have been made before the creation of the game will be explained. These choices include choosing the game engine, choosing which platform to use for the sprite creation and the basic idea of how a multiplayer element can be adapted accordingly.

5.1.1 Unity

For the creation of the game, the game engine Unity was used (Unity Technology, 2020). While Game Maker Studio 2 (GMS2) was also a viable option because GMS2 is easier in use, Unity has a more powerful set of tools. Moreover, Unity can export the game everywhere and in Unity it is possible to create multiplayer games. The game will be an online multiplayer game, because then, hospitalized children can play with their friends and family. Before the online component of the game will be added, the single player game needs to be developed.

In Unity both 3D and 2D games can be created. To keep the workload manageable, the game is a 2D game. Moreover, to be able to see both the players and the area around the players, a top down view was used. In a top down view, there is an elevated viewpoint above the action.

In Unity, scripts are components that are attached to a game object, which tells the game object how to behave or how to interact with other game objects. The language that Unity uses is C#, an object-oriented scripting language.

To create game elements within Unity, a sprite needs to be assigned to an empty game object. This will be explained in the next topic.

5.1.2 Sprites

A sprite is a simple 2D graphical object which is used to create the game's elements. The sprites of this game have been created through Adobe Photoshop (Adobe, 2020). In Adobe Photoshop, the sprites were created as pixel art. Pixel art is a digital art style in which images are created on pixel level. Each sprite was created at a 32x32 pixel size. In the Inspector in Unity, the scale can be adjusted using the Pixels Per Unit option, this can be seen in figure 18. The larger the Pixels Per Unit, the smaller the sprite.

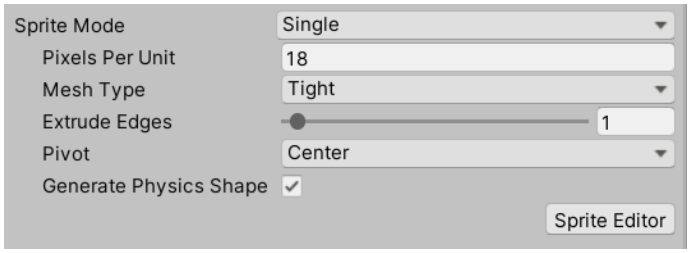

Figure 18: Unity's Inspector: Pixels Per Unit

5.1.3 Level Progression I: Basics

In '*2.5 Literature Review Conclusion'*, it was mentioned that in the digital hospital game, new challenges should arise. To ensure the digital game is challenging, new areas can be discovered. In the prototype, only three rooms can be discovered. However, the idea of the game is that the whole hospital can be discovered as the players unlock more areas of the hospital.

5.1.4 Multiplayer

In the digital hospital game, there should be an option in which children can chose to cooperate or to play against each other. Due to time constraints, the prototype only entails one type of gameplay. According to Englund et al. (2000) cooperation is one of the most important social skills that need development in children. This is in line with the findings of Junttila & Vauras, (2009), who mention that cooperating skills such as learning together or focusing on mutual goals are important in order to relate effectively with other children. Therefore, in the prototype the focus lies on a cooperative gameplay.

5.2 Phase 2: Game Creation I Basics

In phase 2, the basic elements of the game have been created. The basic elements include the layout of the levels, the character animations, the hospital environment creation, and the addition of a multiplayer element.

5.2.1 Tiles

Tiles are used for the creation of 2D levels. After the tiles were created in Adobe Photoshop, the tiles were imported into Unity. Using the tilemap function in Unity, several layers of tiles can be created. The tilemap in the prototype consists of two layers, the background layer, and the wall layer. This to be able to add a tilemap Collider 2D to the walls, to prevent the player from walking into the walls.

After importing the tiles into the Tile Palette, each separate tile can be selected to paint the level. In the actual game, different tile palettes will be used to differentiate between different rooms. Moreover, by adding room-specific sprites, the different rooms can be replicated to look like children's wards or operation wards. However, for the prototype only the grey tiles as visualized in figure 19 were used.

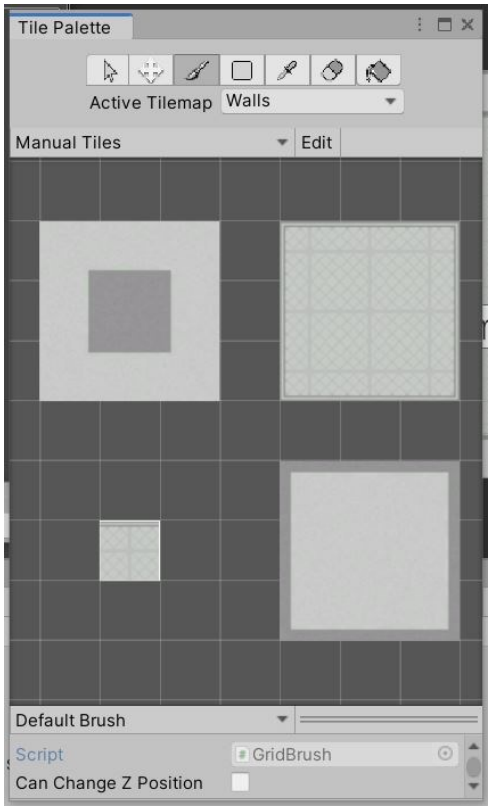

Figure 19: Tile Palette as used in the prototype

5.2.2 Character

The character was also created via pixel art in Adobe Photoshop. The actual digital hospital game will offer a variety of characters from which the player can choose. However, due to a lack of time the prototype only includes one character in two colours. In figure 20, a visualization of the pink game character is shown.

Figure 20: Girl Sprite

In the 2D top view game, the player can move from left to right as well as up and down. The character must include animations to visualize these movements. Each movement: up, down, left, and right, exists of six sprites which are played in a loop. In figure 21 below, six sprites of the character moving up are shown in sequence.

Figure 21: Pink Sprite Walking Up

In Unity, the movement of the character is controlled via both the blend tree as well as a script called “PlayerMovement” which is added as a component to the Player object. In the blend tree, a transition between Idle and Walking is initiated. If the speed element is larger than 0.01, the character will go to the Walking blend tree, this blend tree is shown in figure 22 below.

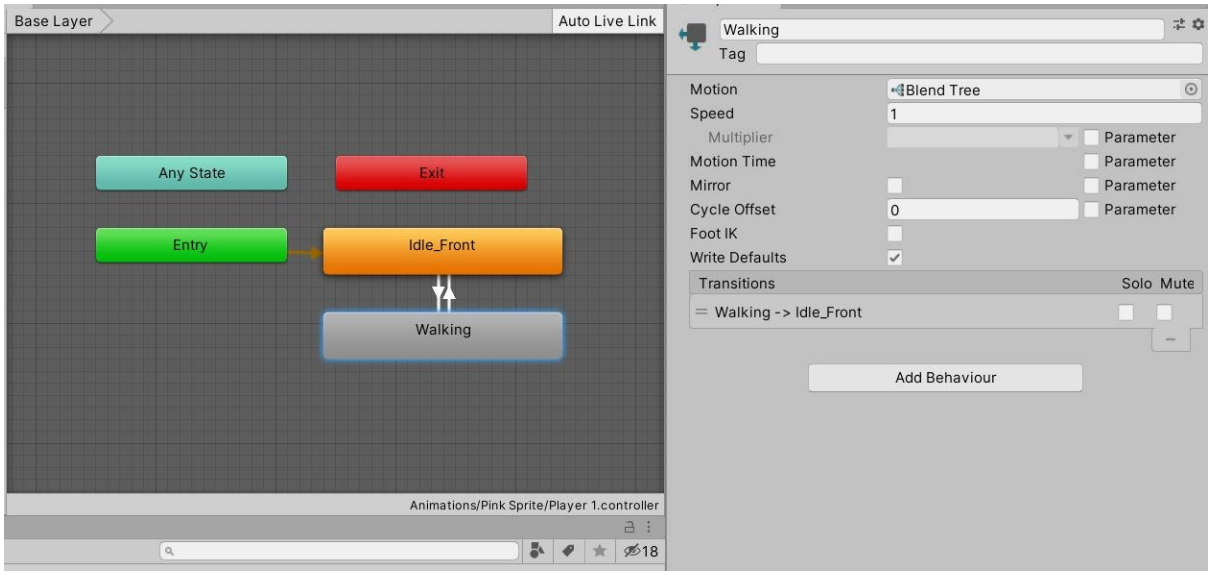

Figure 22:Blend Tree from idle to movement

The layer Walking consists of four animations, these animations represent the four directional movements. By coupling the parameters ‘horizontal’ and ‘vertical’ to both the player animations as well as to the PlayerMovement script, the animations associated with the direction that the player moves in are shown. The layer Walking in the blend tree can be seen in figure 23.

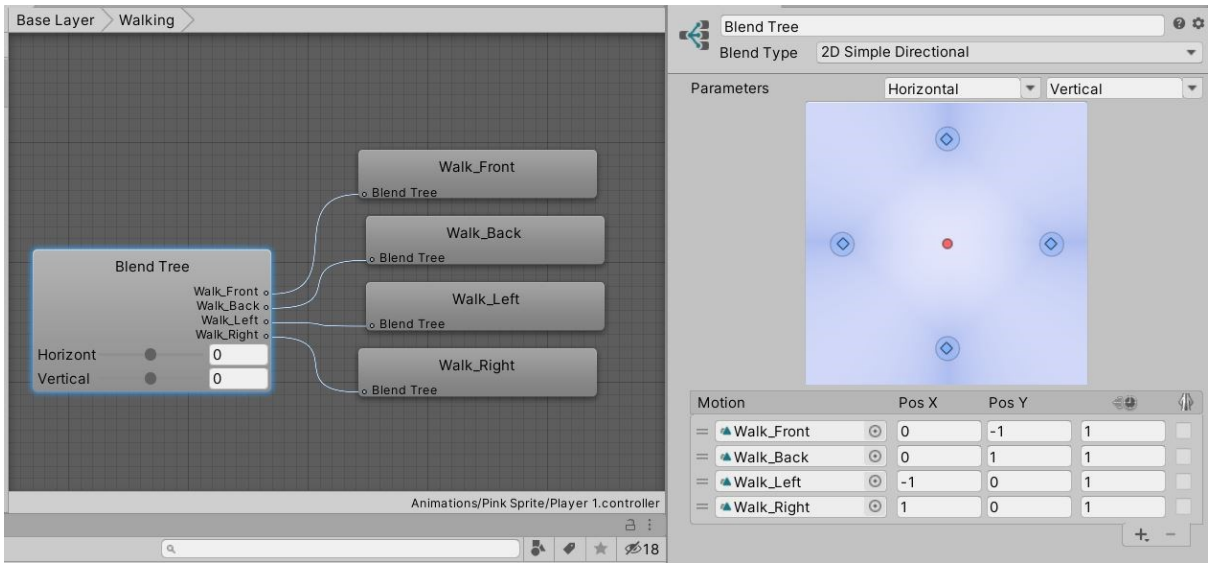

Figure 23: Blend Tree walking layer

5.2.3 Recreating the Hospital Environment

For the game to constitute a hospital environment, sprites that represent hospital elements have been added. In Adobe Photoshop, multiple sprites have been created such as hospital beds, a nurse, and stethoscopes. These can be found in figure 24 below.

Figure 24: Pixel art of hospital elements

5.2.4 Multiplayer

While the actual game will be an online game, due to time constraints, the prototype was created as a local multiplayer game in which both players can play from the same keyboard. One player could move using WASD and one player could move while using the arrow keys. The prototype can currently only be played using a keyboard, but in future implementations physical controllers can be used as well.

An online version will work via the Unity Asset Network Manager. The Network Manager is a component that regulates networking aspects to enable online multiplayer gameplay. The main component Network Manager should be added to an empty game object, it will look like figure 25. Automatically, the corresponding script 'NetworkManager' will be added. The game can be played in several modes: as client, as server or as host. In each mode, the Network Address and Network Port are used. As a client, the game will connect to the address and port as specified in the Inspector. In server or host mode, the game will listen for incoming connections on that same port.

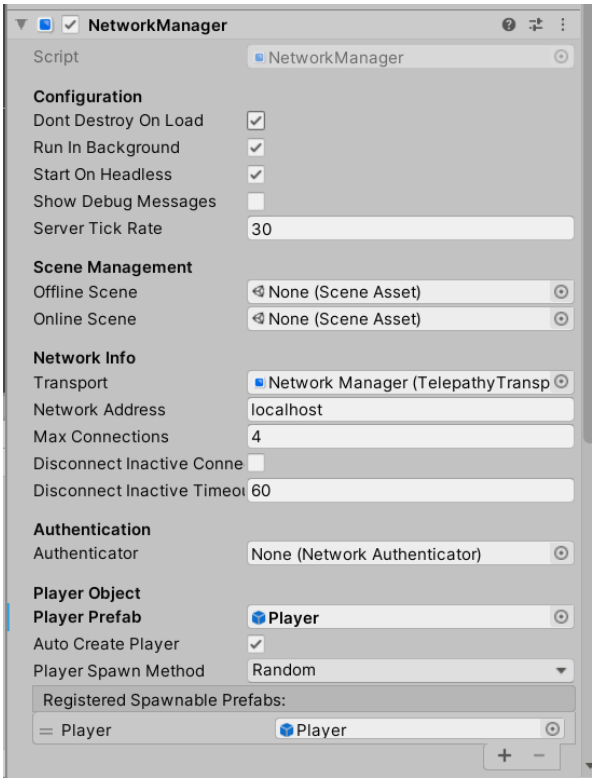

Figure 25: Network Manager

5.2.5 Addiction Measures

While the actual game will have addiction measures, for the prototype these measures have only been explained. Two measures have been created for which feedback has been asked

in the interview that took place after the testing of the prototype in '*6. Evaluation and Adapting the Prototype Accordingly'.*

- The game can keep track on how long the game has been played. The in-game character will mention it is tired if the child has played the game more than two hours consecutively. If the in-game character is sleeping, it is not possible to play the game. After a period, the timer resets and the child can play the game again.
- The game can keep track on the current time. If it is after 8PM, the in-game character will go to sleep. As the in-game character is sleeping, the game cannot be played. This time constraint is added to discourage a child to play into the night.

5.3 Phase 3: Game Creation II Adapting the Game Accordingly

In this phase, the game scenes have been created. The game was created based on the results from the questionnaire as well as the literature research.

5.3.1 Level Progression II: Creating the Levels

In the prototype, only three scenes have been created. To ensure the game will be enjoyable for both children aged 5 as well as children aged 10, the game is not too hard. Moreover, as children have indicated to prefer adventure games, this game has adventuristic aspects such as exploring different rooms. From the results of the questionnaire, it seemed that boys preferred a competitive gameplay while girls prefer cooperative gameplay. As mentioned in '*5.1.4 Multiplayer',* this prototype focuses on cooperative gameplay.

In the first scene, children must talk to the nurse. This is to try and teach the children it is fine to talk to the nurse and asking for explanations. After this interaction, a thought cloud appears next to the nurse with the explanation of how to move on to the next scene. In the first scene, children are expected to collect stethoscopes. In figure 26 on the next page, a screenshot of the first scene, after nurse interaction is visualized. To provide feedback on the amount of collected stethoscopes the total amount of collected stethoscopes are visualized in the top corners for both players.

Figure 26: Prototype 1 Scene 1 (collecting stethoscopes)

After the first scenes, the players must walk through a hallway. At the end of this hallway, a second door is placed. After interaction with this door, the next scene loads. In this scene, too, interaction with the nurse will activate an explanation. In this scene, the children must walk to a square corresponding with their character's colour. Once both characters have interacted with their square at the same time, the door to the next scene will open. In figure 27 below, a screenshot of the second scene, after nurse interaction is visualized.

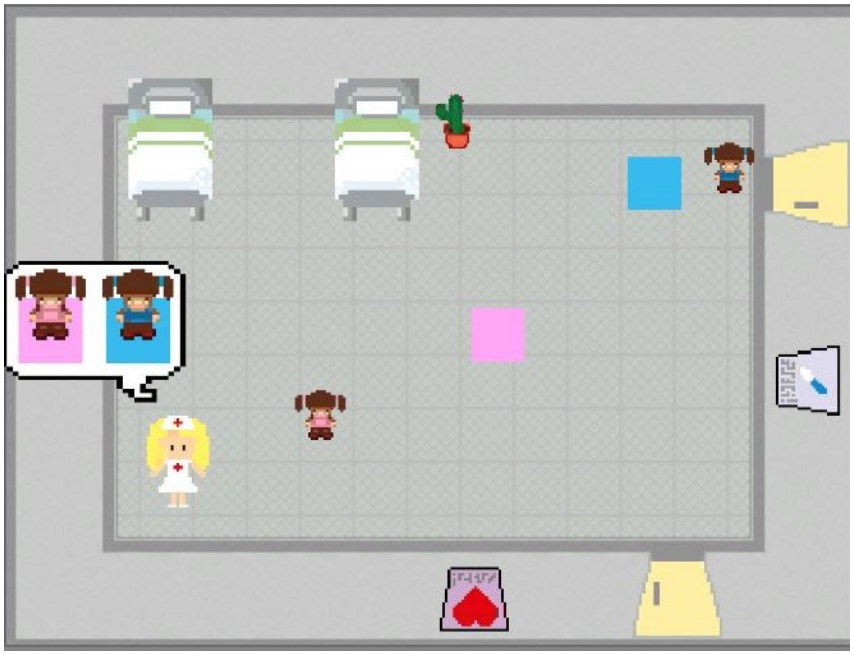

Figure 27: Prototype 1 Scene 2 (square interaction)

After the second scene, the players must walk through a hallway again. At the end of this hallway, another door is placed. Once interacted with this door, the last scene loads. After interaction with the nurse, no explanation is shown. This because the scene exists of a

combination of the previous two scenes. The players must first interact with their square, after which the players must collect their stethoscopes. This is to ensure a gradually increasing difficulty. In figure 28, the hallway of the game is visualized.

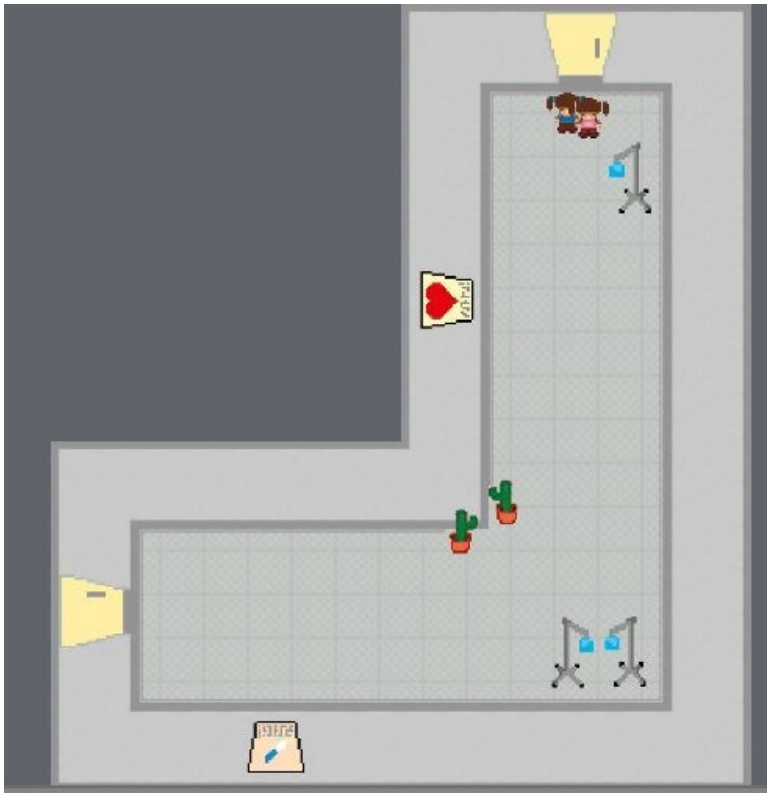

Figure 28: Prototype 1 Hallway

5.3.2 Explanations

The explanations as given by the nurse on how to move to the next scene are provided in the form of images. This, because not every 5-year-old child is ensured to know how to read.

6. Evaluation and Adapting the Prototype Accordingly

In this chapter, the other phases of the iteration process will be explained. These iterations are based on the feedback that has been received during the evaluation of the prototype. The prototype has been tested and adapted three times, in phases 4, 5 and 6, respectively.

6.1 Phase 4: Evaluation and Adaptations of the Prototype I

In the fourth phase of the prototype iteration, the first prototype was tested at Ecare Innovatie. After this, the feedback has been implemented and an improved version of the prototype has been created.

6.1.1 Interview Design

To gather insight into the first prototype, semi-structured interviews have been held at Ecare Innovatie. As most of the Ecare employees work from home, only a handful of employees (n=3) were available for this prototype test. Because of the small sample size, the regulations as set by the University of Twente and by the study of Creative Technology could be followed.

For the interview, a set of questions was prepared which can be found in Appendix G. Besides the set of questions, the semi structured interview offers the chance to ask follow-up questions or clarification questions. As Dutch is the mother tongue of all participants, the interviews were held in Dutch to ensure the participants are comfortable. The interviews have been translated and can be found in Appendix H.

6.1.2 Results

All participants have indicated that they thought the game would help decrease feelings of loneliness that hospitalized children may experience. The participants mentioned the game being a good initiative, the characters were nice, and the game was fun to play.

Chat box

All participants have indicated that a chat box function might be a good addition. A chat box function invites children to contact each other, which will improve the social aspect of the game. Moreover, as one participant stated, *“I think a chat function would be a nice addition. I can’t imagine children using Skype or Discord to interact with each other, so a chat function would be ideal”.*

Educational Elements

Concerning the educational elements, diverse opinions were observed. While two of the participants indicated that the addition of educational elements would be nice, one patient disagreed stating "*there is nothing wrong with a game that is just for fun, there is no need to implement educational elements".*

Addiction

Both ideas for reducing the chances of addiction were positively received. However, one participant stated that the time limits that were originally set had to be re-evaluated as the participant would decrease the two-hour maximum amount of gameplay to one hour.

6.1.3 Adaptations

Nurse

One participant mentioned that it was not clear that interaction with the nurse was needed. Adding a small hint in the form of an exclamation point above the nurse might guide players to the nurse. This change is visualized in figure 29 below.

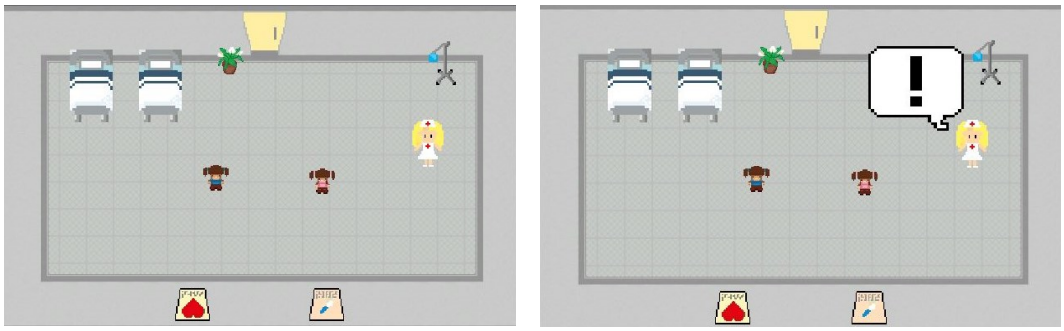

Figure 29: Nurse interaction before (left) and after (right) addition of exclamation point

Sound Effects

Participants also mentioned that the game was very silent. In the improved prototype not only background music has been added, but sound effects as well. By adding sound effects, feedback can be given. A pickup sound effect is added to stethoscopes, so the player hears whenever a stethoscope is picked up. Moreover, a switch sound effect is added whenever a player walks over the square. This way, the players know when their square is activated. Lastly, if the challenges are completed, an opening door sound effect is added, to let the players know that the door has been opened.

The menu background music is different from the in-game background music. This was added to make it clear that the player is playing the game when leaving the menu screen. In the first scene, an empty game object has been created with an Audio Source. A script was added to this game object which starts the music. To ensure the game music does not reset with each level, a ‘don’t destroy on load’ aspect was added. The menu, too, has an empty object with an Audio Source and a script. This script starts with the statement to delete the game object with function ‘don’t destroy on load’. This was to ensure the menu will never play both music elements at the same time. In figure 30 below, the game object of the main menu with the Audio Source is displayed.

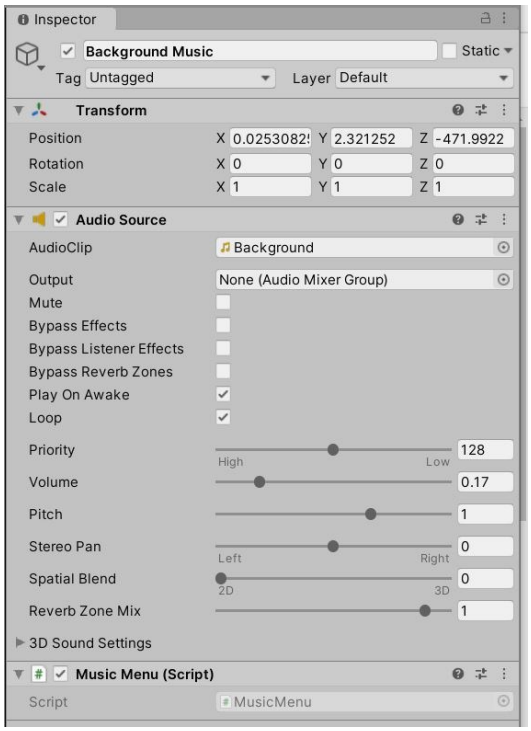

Figure 30: Game object for background music in main menu

Scene Transition

One participant mentioned that the scene transition in the first prototype was abrupt. When walking through the door, the next level starts immediately. Therefore, a small scene transition was added in between the scenes. When a scene has been completed, the transition will be a fade-out. The next scene will start with a fade-in. The fade transitions have been created by animating a black screen’s opacity from and to 100%. For example, for the fade-in transition, the screen will start with a black screen with opacity 100% and over time the transition moves to an opacity of 0%, it will then seem as if the black screen disappears. the fade-out animation will be the opposite of the fade-in animation. A visualization of the fade-in animation can be found in figure 31 on the next page.

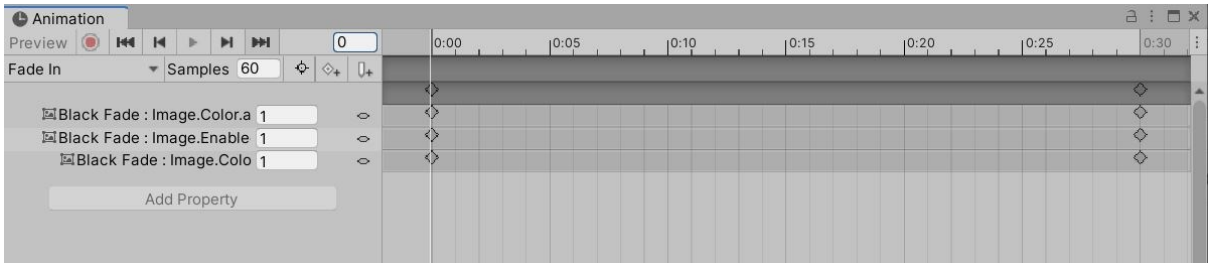

Figure 31: Fade in animation

6.2 Phase 5: Evaluation and Adaptations of the Prototype II

The second round of feedback was received through online interviews. Several people (n=5) have been interviewed via Skype and Discord.

6.2.1 Interview Design

The interviews of the evaluation of the second prototype were online interviews. While connected via Skype or Discord, a build of the second prototype was send to the participants in the form of a zip file. After extracting all elements of the zip file, participants were able to start the game. Participants were asked to share their screen, and after completion of the game the participant's opinion was asked via prepared questions. This interview, too, was semi-structured in order to be able to ask follow-up questions. As all participants were Dutch, the interviews were held in Dutch. The answers of the participants have been translated and added to Appendix J.

6.2.2 Results

All participants have indicated that they thought the game would be fun to play if they were a child between the ages of 5 and 10. The participants thought that the difficulty of the game rises with each levels, however one participant stated that the game is not that difficult because the nurse gives a clear explanation. Participants liked that the game represented a hospital environment stating "[I liked] *To learn in such a fun way that you can go the nurse for explanations [...]. And I liked that you had to collect stethoscopes, that it is medical equipment"* and *"I really liked the game was created to represent a hospital environment. There were nice elements such as the stethoscopes"*.

Chat box

While in the first round of feedback, participants stated that a chat box would be a nice addition, the opinions of the participants in the second round were diverse. While all participants saw the positive effects of an addition of some sort of communication, not all participants agreed that a chat box was the way to go. One participants stated that it might be too hard to play the game while also chat with the other player, and one participant stated that she preferred to talk with others while playing a game instead of using a chat box.

Educational Elements

All participants thought that educational elements would be a nice addition to the game. One participant mentioned that adding educational elements are coupled with risks. The participant stated "*But there are always risks. For example, if you add arithmetical elements and children dislike arithmetic, they won't play the game anymore"*.

Addiction

The idea of a maximum amount of playable time in the game was an idea that was positively embraced by all participants. For the second idea, concerning the game being able to track the current time and letting the in-game character sleep after 8PM to discourage children to play into the night, different opinions were observed. The basic idea of the measure was accepted, but participants mentioned that children might have a different sleeping schedule due to medicines that might have to be taken late at night. If children are already awake, they might want to play the game for a few more minutes before going to sleep. Some participants pointed out that the time had to be adjusted from 8PM to 1AM.

Sound Effects

Besides the questions that were also asked in the first prototype evaluation round, these interviews had also a question concerning the newly added sound effects. All participants liked the sound effects and one participant stated "*I think the door sound especially helped because otherwise I would not have known to go to the door. Like, I would have missed that the door opened".* This suggests that the sound effects help in providing positive feedback.

6.2.3 Adaptations

Most of the improvements concerned the future game rather than the prototype. Participants mentioned that adding achievements would be a nice addition as well as some more different rooms to explore as the prototype is 'too grey'. Moreover, some participants thought the

hallways in between the scenes were a bit boring. These ideas for future improvement will be explained in '*6.4 Future Adaptations'*.

Stethoscopes

For the prototype itself, the improvement was moving the total amount of stethoscopes collected, as not all participants were able to see them in the top corners. This improvement is visualised in figure 32 below.

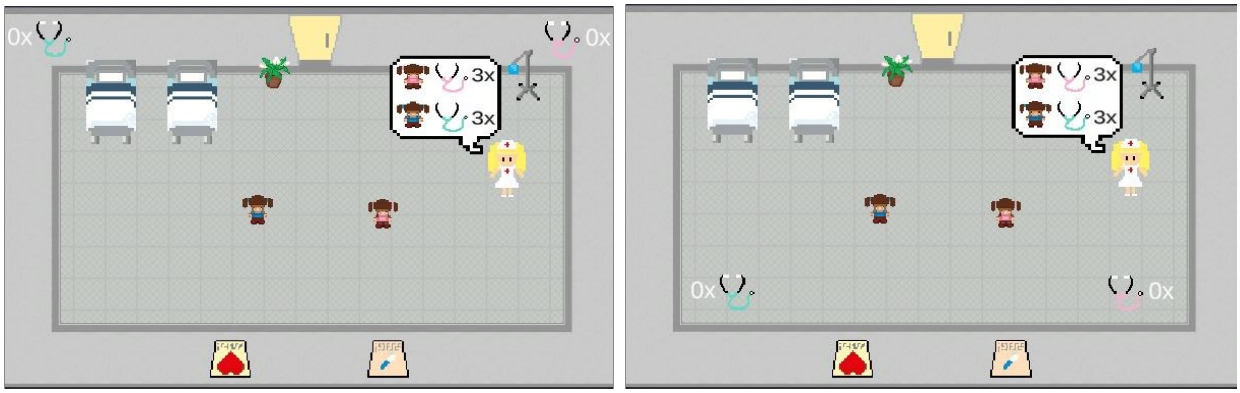

Figure 32: Total collected stethoscopes before (left) and after (right) implemented feedback

6.3 Phase 6: Evaluation and Adaptations of the Prototype III

While in an ideal case, the prototype would have been tested with hospitalized children, the third round of evaluation was conducted with two children. The children were aged 8 and 10.

6.3.1 Interview Design

As the third round of evaluation was conducted with children, the interview was conducted in a slightly different way. The language usage throughout the interview was adapted. After the explanation of the research was given, the children could play the game. They were offered the opportunity to play with each other or to take turns. The children decided they wanted to play together. After finishing the game, some questions were asked to get the children's opinion. There were no questions asked concerning addiction. As both participants were Dutch, the interview was in Dutch as well. The translated answers are added to Appendix K

6.3.2 Results

Both participants stated that the explanation that the nurse gave was clear and that they understood the challenges. Both participants thought the game was fun to play, and they even played the game for a second time just for fun. Both participants thought that this game would

help reduce loneliness in hospitalized children, as one participant stated, '*I think so, because you can do something together*'.

Chat box

Both participants thought some way of communicating would be a nice addition to the game. A chat box would be good, but one participant stated that calling would be even more convenient.

Educational Elements

Both participants agreed that educational elements would be nice addition.

6.3.3 Adaptations

The participants liked the characters as well as the design of the game with different rooms and the challenges in the game. Neither children thought anything in the game needed changing.

6.4 Future Improvements

The feedback from every evaluation round has been collected and combined to form future adaptations.

6.4.1 Personalization

The first future improvement concerns personalization. In the third evaluation round, both children have indicated that creating a personal character would be a nice addition. Besides personalizing the character, the hospital room in which the character sleeps can be personalized with items that can be collected throughout the game. In addition, the character can be given a name, to make the game even more personal.

6.4.2 Achievements

Another future improvement is implementing achievements. Achievements make the game more challenging, as new goals can be set to complete an achievement. The achievements can be offered in the form of minigames or completing several scenes. After an achievement has been completed, new outfits, items for in the room or new areas can be unlocked.

6.4.3 Hospital Environment

While the prototype already represented a hospital environment, the actual game should include multiple hospital areas such as children's wards and operation rooms. The first step in creating different rooms, is changing the grey colour palette to create more tilemaps in Unity. Besides different tilemaps, room-specific sprites can be created in Adobe Photoshop. For example, for an operation room, an operation bed can be created as well as instrument trays.

6.4.4 Addiction Measures

During the prototype testing sessions, feedback was acquired regarding the addiction measurements. While the prototype did not include any addiction prevent measures, the actual game will include these measurements.

- **Gameplay time.** The game will keep track on how long the game has been played. If the threshold of two hours is exceeded, the in-game character will mention that it is tired. The child will then not be able to play anymore. After a certain amount of time, the timer resets and the child can play again.
- **Current time.** The game will also keep track on the current time. If it is after 1AM, the game cannot be played which is visualized as the in-game character sleeping. This measure is created to discourage a child to play into the night.
- **Cooldown.** The game can implement cooldown times. For instance, if a minigame were to be added in which the child can race in a wheelchair, a cooldown time of 5 minutes can be added. This entails that the minigame can only be played again after waiting for 5 minutes. This cooldown time can also be added to the nurse, where the nurse can mention that she has errands to run. Or the cooldown can be added to new areas for instance if the new area is the operation room, the operation room can be in use.

6.4.5 Educational Elements

In the actual game, educational elements can be implemented as well. These educational elements can be school education, or hospital educational elements.

- **School.** The school educational elements can include arithmetical questions or spelling games. While there is a difference in 5-year-old's school educational level when compared to a 10-year-old's school educational level, these differences can be overcome. The game can include an option in which children can put their current school level, and the game will adapt accordingly. Another option can be that the game

keeps track on the previously given answers. If these answers are correct, the game can gradually increase the level of difficulty.

- **Hospital.** The hospital educational elements can include getting to know hospital procedures or getting to know the child's ailment. This information can be visualized in an educational video after which questions can be asked for example if children enter the in-game operation room.

6.4.6 Communication

In the actual game, a communication option should be added. This will enable children to have contact with each other. A chat box option was evaluated during the prototype test sessions. While all participants thought a communication option would be a nice addition, some participants thought that it would be more convenient to call than to have a chat box function.

7. Discussion

In this section the research questions as stated in the introduction will be answered. Besides answering the research question, this section will also touch upon this research's limitations as well as recommendations for the future.

7.1 Conclusion

The main theme of this research was loneliness in hospitalized children. In previous research it has already been reported that the loneliness that children experience while hospitalized originates because of a disconnection. This disconnection entails two forms, children are disconnected from their home environment as well as from their friends and family. It is of importance to reduce loneliness, not only because feeling lonely is unpleasant, but also because if not tackled feelings of loneliness may lead to behavioural and psychological difficulties in children.

In addition to research into loneliness, by conducting a literature research information was gathered about digital game addiction. On the one hand digital games have a positive impact on a child's health, on the other hand, however, children are at risk for a digital game addiction. While less than 10 percent of children worldwide are addicted to digital games, a digital game addiction can lead to an increased sense of loneliness. Children get addicted to digital games if they have an obsessive need for playing video games in such a way that it impairs daily life activities. Since the digital game is developed to reduce loneliness in hospitalized children, a digital game addiction would be an adverse effect. Therefore, some measurements were created that can be embedded in the game, to minimise the chances of a child getting addicted.

Furthermore, multiple digital games have already been developed for the hospital environment, however, these games either focus on reduction of anxiety or are not created for children aged 5-10. This indicates a lack of hospital games that focus on socialization for children aged 5-10.

An online questionnaire was used to gather insight into children's game preferences. These results indicated that children prefer to play digital games with others rather than playing digital games alone. Boys prefer to play against one another whereas girls prefer to play together. These results are in line with findings in the literature research. The preferred game genres include adventure, action and educational and the majority of the respondents think that a multiplayer digital game can help to reduce loneliness.

With the results of the online questionnaire, a prototype of the digital hospital game has been developed. This prototype has been developed through iteration phases of creation, evaluation and implementing the feedback. After two evaluation sessions, the prototype was tested by two children. Both children have indicated to like the game and think the game can help to reduce loneliness in hospitalized children. The final prototype of the digital hospital game thus shows promising results in reducing loneliness while not leading to an online digital addiction.

7.2 Limitations

Some limitations were encountered during this research. The largest limitation is that it was not possible to reach the target group of hospitalized children. The children's needs were thus based on scientific research which may result in inadequately addressing the target population due to a lack of understanding. The online questionnaire as well as the interviews were conducted with children who did not have to be hospitalized. Children who have never been hospitalized may have different views and opinions on subjects regarding loneliness than children who have experienced the hospital environment regularly.

Moreover, the online questionnaire had only 8 responses. It is hard to base design choices on the opinion of few respondents, as these respondents may not accurately describe the target group. A bigger sample size would have given a better overview of the needs of the target group.

Another limitation of this study is the broad age group. For younger children, the age categories should be broken up into different categories based on age. These age categories being: 4-6, 7-9, 10+11. A game which is great for a 5-year-old may have a completely different appeal to a 10-year-old. For example, children who fall in the category of 4-6 may not be able to read while children aged 10+11 may be more socially developed. The limitation is thus that the developed game is fine for children aged 5-10, while the game could have been better if the focus would have laid on a smaller age category.

7.3 Recommendations for Future Research

For future research, some recommendations have been created. First of all, as this research has indicated that some kind of communication would be an addition to the prototype, research can be conducted into the advantages of different forms of communication. One option is the addition of a chat box. A risk that a chat box brings is that personal data can be sent. To counteract this risk, the messages may only be sent in the form of emoticons. This research has indicated that a chat box would be a nice addition, however, calling might be more

effective. This is the second option. When connecting children via voice chat, children can communicate while talking with each other.

Second of all, in this research only the collaboration game mode was tested. In future research, the competitive game mode should be created and tested as well. Moreover, a third game mode can be created in which the competitive and cooperative elements are alternated. In addition, this research indicated that the inclusion of educational elements would be an addition. In future research, the addition of educational elements can be tested.

Lastly, the game should be developed in such a way that more areas can be discovered as well as new challenges arise. This game should then be tested with the right target group, hospitalized children, in the right environment, the hospital.

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Appendices

Appendix A: UCLA Loneliness Scale (Version 3)

TABLE 1
UCLA Loneliness Scale (Version 3)

Instructions: The following statements describe how people sometimes feel. For each statement, please indicate how often you feel the way described by writing a number in the space provided. Here is an example:

How often do you feel happy?

If you never felt happy, you would respond "never"; if you always feel happy, you would respond "always."

NEVER	RARELY	SOMETIMES	ALWAYS
1	2	3	4

*1.	How often do you feel that you are "in tune" with the people around you?	_____
2.	How often do you feel that you lack companionship?	_____
3.	How often do you feel that there is no one you can turn to?	_____
4.	How often do you feel alone?	_____
*5.	How often do you feel part of a group of friends?	_____
*6.	How often do you feel that you have a lot in common with the people around you?	_____
7.	How often do you feel that you are no longer close to anyone?	_____
8.	How often do you feel that your interests and ideas are not shared by those around you?	_____
*9.	How often do you feel outgoing and friendly?	_____
*10.	How often do you feel close to people?	_____
11.	How often do you feel left out?	_____
12.	How often do you feel that your relationships with others are not meaningful?	_____
13.	How often do you feel that no one really knows you well?	_____
14.	How often do you feel isolated from others?	_____
*15.	How often do you feel you can find companionship when you want it?	_____
*16.	How often do you feel that there are people who really understand you?	_____
17.	How often do you feel shy?	_____
18.	How often do you feel that people are around you but not with you?	_____
*19.	How often do you feel that there are people you can talk to?	_____
*20.	How often do you feel that there are people you can turn to?	_____

Scoring:
Items that are asterisked should be reversed (i.e., 1 = 4, 2 = 3, 3 = 2, 4 = 1), and the scores for each item then summed together. Higher scores indicate greater degrees of loneliness.

Note.

Figure 33: UCLA Loneliness Scale (Version 3) (Russell, 1996, p.23)

Appendix B: Each Factor Type and Accompanying Question

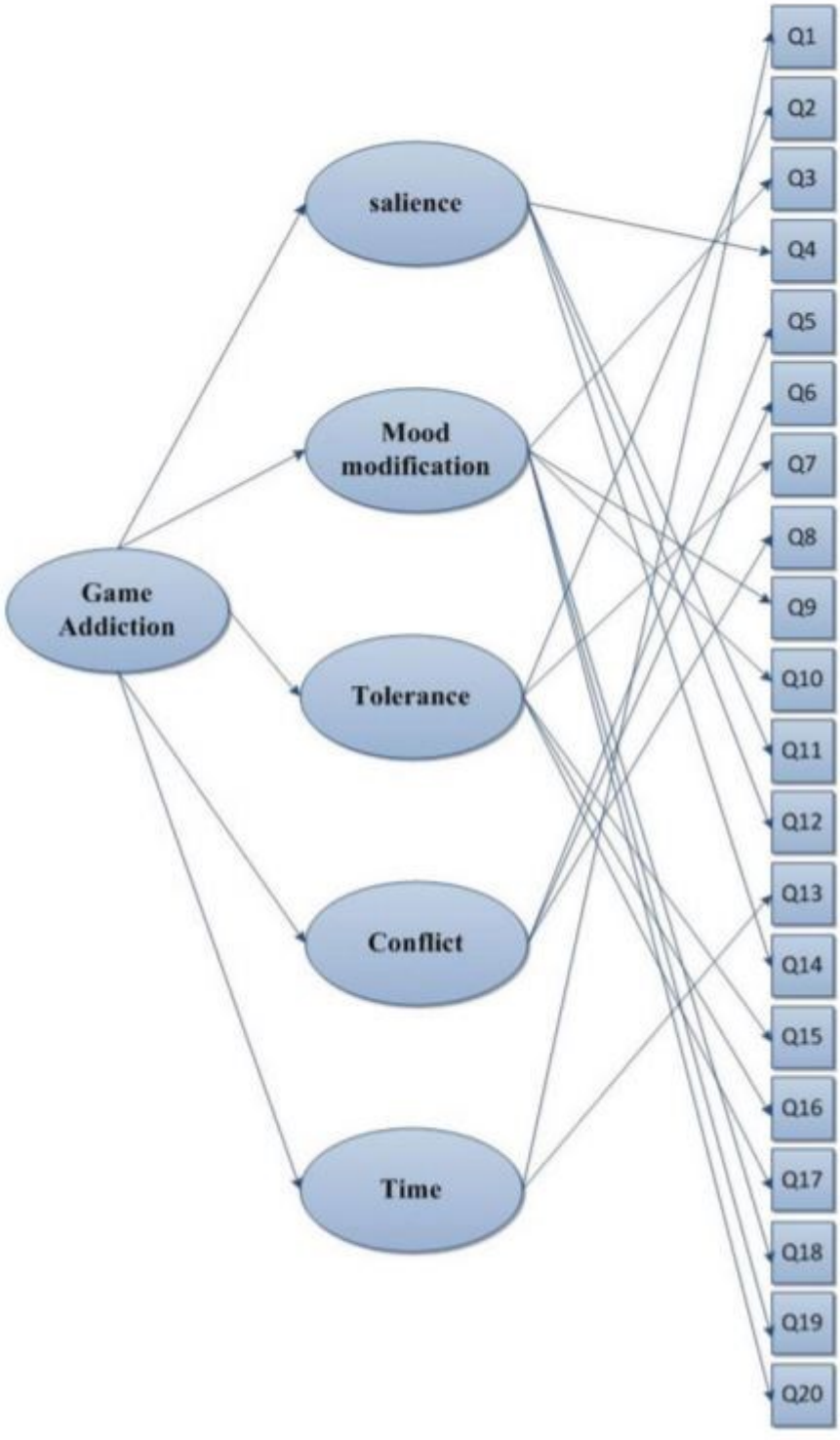

Figure 34: Each factor with accompanying question (Hung et al., 2018, p.311)

Table 1 Game addiction questionnaire

No.	Question
1	How often would you play game exceed to originally anticipated time?
2	How often do you put aside the completed or executed things and use time to play game?
3	How often do you play games get the excitement even interpersonal intimate interaction?
4	How often do you make new friends in the online game?
5	How often do you spend too much time to playing online game and being around people who complain or blame?
6	Do you spend too much time on the game which (have begun to cause, academic setback?
7	How often do you have to do something else before opening the game?
8	How often do you have to open start the game before you do anything else?
9	How often do you play the game by recall pleasant thing to stop thinking troubled things?
10	How often do you expect to be able to start yet game to play?
11	How often do you fear less the game, life becomes boring, empty?
12	How often do you play the game sacrificing sleep at night?
13	When you playing the game, how often you tell yourself "just a few minutes"?
14	Have you ever ordered at bedtime will finish off the game before falling asleep?
15	Have you ever found yourself playing the game, in fact, don't really feel interesting?
16	Do you feel like you have to spend more and more time in online game?
17	As long as there is free times will want to play the game?
18	When you finally have access to the game, feel happier and joyful; cheerful; delighted?
19	When I tried to cut down or stop using the internet, I would feel down, depressed or cranky
20	Suddenly you want to terminate the game, make you feel very bad

Figure 35: Game Addiction Questionnaire (Hung et al., 2018, p. 310)

Published version:

https://utwentebs.eu.qualtrics.com/jfe/form/SV_9X23oqyAgTojJ0F

Preview:
https://utwentebs.eu.qualtrics.com/jfe/preview/SV_9X23oqyAgTojJ0F?Q_SurveyVersionID=current&Q_CHL=preview

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Start of Block: Intro

Q1.1 Beste mevrouw/heer
Allereerst bedankt voor uw tijd!
Mijn naam is Jolien Valk en voor mijn afstudeeronderzoek van de studie Creative Technology aan de Universiteit Twente doe ik onderzoek naar 'eenzaamheid in kinderen (5 tot 10 jaar) die opgenomen zijn in het ziekenhuis'.
Om ethische redenen mag deze online vragenlijst alleen worden ingevuld door een ouder/voogd. Gelieve dit wel te doen in samenwerking met uw kind.
Voor het invullen van deze vragenlijst hoeft uw kind **niet** in het ziekenhuis opgenomen te zijn (geweest). Wel, moet uw kind tussen de 5 en 10 jaar oud zijn. Deze vragenlijst duurt maximaal 10 minuten.
Deelname aan deze online vragenlijst is geheel vrijwillig en u kunt zich op elk gewenst moment terugtrekken uit dit onderzoek. Om uw privacy te beschermen wordt er op geen enkele wijze vertrouwelijke informatie over u of uw kind naar buiten gebracht. Uw gegevens worden anoniem gemaakt door middel van een pseudoniem, zoals deelnemer1. Op deze manier kan ik de data wel onderzoeken, zonder dat de persoonsgegevens van u of uw kind bekend worden.
Als u graag contact op wilt nemen met vragen over dit onderzoek, kunt u mij bereiken via j.valk@student.utwente.nl.
Als u deze online vragenlijst start en invult, gaat u akkoord en geeft u toestemming aan mij om de ingevulde gegevens te gebruiken.
Klik op de pijl om de vragenlijst te beginnen.

Skip To: Q1.2 If Beste mevrouw/heer Allereerst bedankt voor uw tijd! Mijn naam is Jolien Valk en voor mijn afstude... Is Displayed

---

Q1.2 **In dit gedeelte van de vragenlijst zal ik vragen naar de inhoud van de spellen, indien uw kind wel eens spellen speelt. Het gaat hier vooral om online/internet/applicatie spellen en niet over bordspellen.**
Klik op de pijl om door te gaan.

Skip To: Q1.3 If In dit gedeelte van de vragenlijst zal ik vragen naar de inhoud van de spellen, indien uw kind we... Is Displayed

---

Q1.3 Speelt uw kind wel eens een spelletje?

- ○ Ja (1)
- ○ Nee (2)

Skip To: End of Survey If Speelt uw kind wel eens een spelletje? = Nee
Skip To: Q1.4 If Speelt uw kind wel eens een spelletje? = Ja

Q1.4 Welk platform heeft de voorkeur voor het spelen van spelletjes?

- ○ Tablet (1)
- ○ Laptop/computer (2)
- ○ Mobiele telefoon (3)
- ○ Anders, namelijk: (4) _____

End of Block: Intro

Start of Block: Game Preferences p1

Q21 **In de volgende 4 vragen kunt u aangeven in welke mate de antwoorden uw kind aanspreken.**
Bijvoorbeeld:

Als ik een spel speel, heb ik het liefste dat het spel ... is.

	1 (1)	2 (2)	(3)	4 (4)	5 (5)	
Voorspelbaar	○	○	○	○	○	Onbekend

Q2.1 **U hoeft in dit voorbeeld niks in te vullen.**

Klik op de pijl om door te gaan.

Skip To: Q2.2 If U hoeft in dit voorbeeld niks in te vullen. Klik op de pijl om door te gaan. Is Displayed

Q2.2 In een spel zou ik het liefste:

	1 (1)	2 (2)	3 (3)	4 (4)	5 (5)	
Alleen spelen	○	○	○	○	○	Met anderen spelen
Samenwerken	○	○	○	○	○	Concurrentie/tegen elkaar spelen
Ontspannen/rust hebben	○	○	○	○	○	Tijdsdruk, snelheid en iets wat veel aandacht vraagt willen
Vrolijke elementen hebben	○	○	○	○	○	Enge elementen hebben waarvan ik moet schrikken

End of Block: Game Preferences p1

Start of Block: Game Preferences p2

Q3.1 **De volgende vragen zijn meerkeuzevragen. Soms kunt u meerdere antwoorden invullen, dit staat dan aangegeven.**

Klik op volgende en vervolgens op de pijl om door te gaan.

Skip To: Q3.2 If De volgende vragen zijn meerkeuzevragen. Soms kunt u meerdere antwoorden invullen, dit staat dan... Is Displayed

Q3.2 Speelt uw kind wel eens online/internet/applicatie spellen met anderen?

○ Ja (1)

○ Nee (2)

Skip To: Q3.3 If Speelt uw kind wel eens online/internet/applicatie spellen met anderen? = Ja

Skip To: Q3.4 If Speelt uw kind wel eens online/internet/applicatie spellen met anderen? = Nee

Q3.3 Bij deze vraag zijn meerdere antwoorden mogelijk. Als uw kind spellen met anderen speelt, met wie speelt hij/zij dan?

- ☐ Vrienden van school (1)
- ☐ Vrienden van sport (2)
- ☐ Vrienden uit de buurt (3)
- ☐ Broers en/of zussen (4)
- ☐ Ouders (5)
- ☐ Anders, namelijk: (6)

_____

Q3.4 Bij deze vraag zijn meerdere antwoorden mogelijk. Wat voor genre spellen heeft de voorkeur van uw kind?

- ☐ Educatie (1)
- ☐ Actie (2)
- ☐ Avontuur (3)
- ☐ Sport (4)
- ☐ Puzzel (5)
- ☐ Muziek (6)
- ☐ Anders, namelijk: _____ (7)

End of Block: Game Preferences p2

Start of Block: Eenzaamheid

Q22 **De volgende vragen zijn op een schaal van helemaal eens tot helemaal oneens.**

	Helemaal eens (1)	Eens (2)	Neutraal (3)	Oneens (4)	Helemaal oneens (5)
Voorbeeld (1)	○	○	○	○	○

Q4.1 **U hoeft in de dit voorbeeld niks in te vullen. Klik op volgende en vervolgens op de pijl om door te gaan.**

Skip To: Q4.2 If U hoeft in de dit voorbeeld niks in te vullen. Klik op volgende en vervolgens op de pijl om door... Is Displayed

Q4.2 Welk antwoord geeft uw kind op de volgende vragen:

	Helemaal eens (1)	Eens (2)	Neutraal (3)	Oneens (4)	Helemaal oneens (5)
Ik voel mij wel eens alleen (1)	○	○	○	○	○
Als ik me alleen voel, dan mis ik een goede vriend(in) (2)	○	○	○	○	○
Als ik me alleen voel, dan mis ik meerdere/een groep vrienden (3)	○	○	○	○	○
Ik denk dat een spel waarin ik met of tegen anderen kan spelen, zou helpen om eenzaamheid te verminderen (4)	○	○	○	○	○

End of Block: Eenzaamheid

Start of Block: Algemene vragen

Q5.1 Algemene vragen

Klik op de pijl om door te gaan.

Skip To: Q5.2 If Algemene vragen Klik op de pijl om door te gaan. Is Displayed

Q5.2 Wat is de leeftijd van uw kind?

_____

Q5.3 In welke groep zit uw kind?

_____

Q5.4 Uw kind is een:

- ○ Jongen (1)
- ○ Meisje (2)
- ○ Anders (3)
- ○ Zeg ik liever niet (4)

Q5.5 Is uw kind ooit opgenomen geweest in het ziekenhuis?

- ○ Ja (1)
- ○ Nee (2)

Skip To: Q5.6 If Is uw kind ooit opgenomen geweest in het ziekenhuis? = Ja
Skip To: End of Block If Is uw kind ooit opgenomen geweest in het ziekenhuis? = Nee

Q5.6 Mag er eventueel met u contact opgenomen worden voor een online interview?

- ○ Ja (1)
- ○ Nee (2)

Skip To: Q5.7 If Mag er eventueel met u contact opgenomen worden voor een online interview? = Ja
Skip To: End of Block If Mag er eventueel met u contact opgenomen worden voor een online interview? = Nee

Q5.7 Wat is uw emailadres?

_____

End of Block: Algemene vragen

Q1.3	Q1.4	Q1.4_4_TEXT	Q21_1	Q2.2_1	Q2.2_2	Q2.2_3	Q2.2_4	Q22_1
Nee								
Ja	Anders, namelijk:	Bordspel	5	4	4	2	1	
Ja	Tablet		1	5	3	3	3	
Ja	Tablet		4	5	1	2	2	
Ja	Tablet		4	5	5	3	1	
Ja	Mobiele telefoon		4	5	1	2	1	
Ja	Mobiele telefoon		4	4	3	3	3	
Ja	Laptop/computer		5	4	2	2	1	

Q3.2	Q3.3	Q3.3_6_TEXT	Q3.4	Q3.4_7_TEXT
Nee			Educatie,Actie,Avontuur,Puzzel	
Ja	Vrienden uit de buurt,Broers en/of zussen,Ouders,Anders, namelijk:	Opa	Educatie,Actie,Avontuur	
Ja	Vrienden van school,Broers en/of zussen		Avontuur	
Ja	Vrienden van school,Broers en/of zussen		Educatie,Actie,Avontuur,Muziek	
Nee			Actie,Avontuur,Muziek	
Ja	Vrienden van school,Vrienden van sport,Broers en/of zussen		Actie,Avontuur	
Ja	Vrienden van school,Ouders		Educatie,Actie,Avontuur,Anders, namelijk:	Bouwen met Lego/ fantasie

Q4.2_1	Q4.2_2	Q4.2_3	Q4.2_4
Eens	Eens	Eens	Eens
Helemaal eens	Helemaal eens	Neutraal	Eens
Helemaal oneens	Helemaal oneens	Helemaal oneens	Eens
Helemaal oneens	Oneens	Oneens	Eens

Eens	Eens	Helemaal eens	Oneens
Oneens	Eens	Neutraal	Eens
Neutraal	Oneens	Eens	Eens

Q5.2	Q5.3	Q5.4	Q5.5	Q5.6	Q5.7
5	1	Jongen	Nee		
10	6	Jongen	Nee		
6	3	Meisje	Ja	Nee	
7	4	Jongen	Nee		
10	6	Meisje	Nee		
8	5	Jongen	Nee		
10	groep 6	Meisje	Nee		

Appendix F: Children's Reported Feelings of Loneliness Per Question

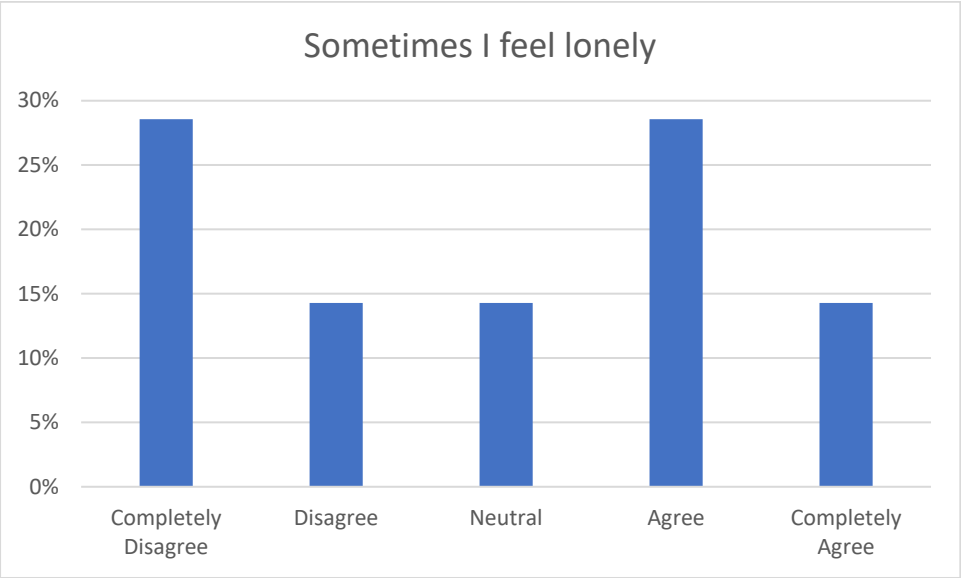

Figure 36: Bar graph loneliness. Question: Sometimes I feel lonely

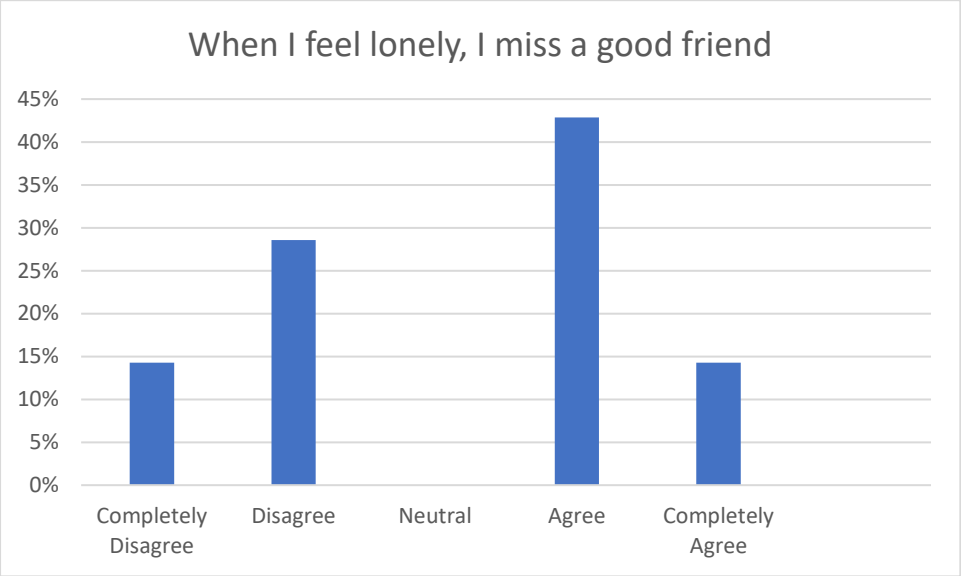

Figure 37: Bar graph loneliness. Question: When I feel lonely, I miss a good friend

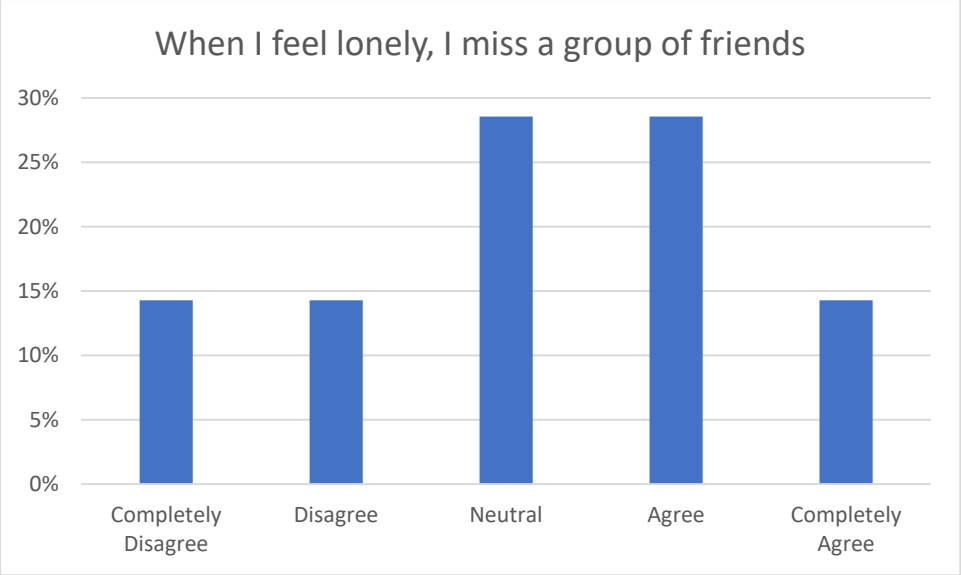

Figure 38: Bar graph loneliness. Question: When I feel lonely, I miss a group of friends

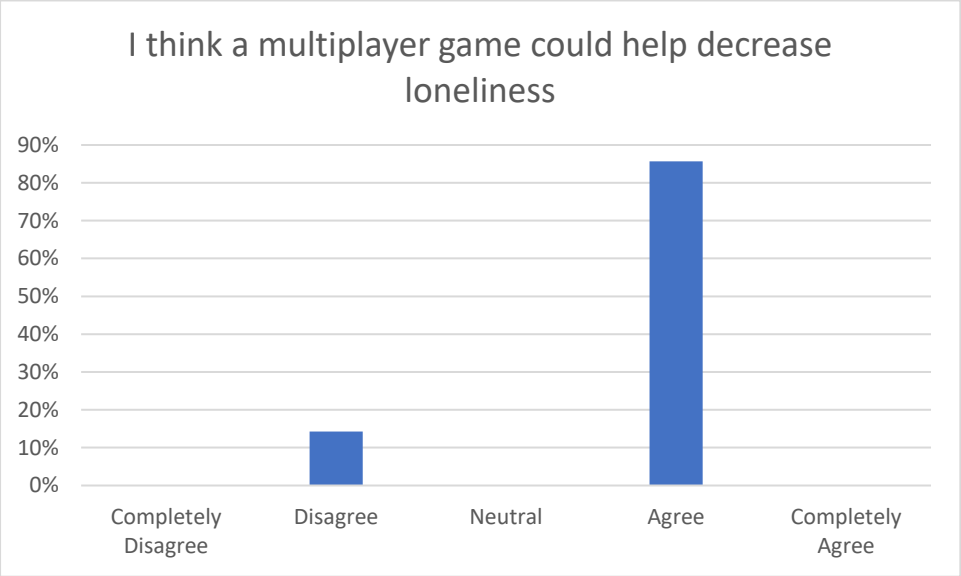

Figure 39: Bar graph loneliness. Question: I think a multiplayer game could help decrease loneliness

Appendix G: Children's Reported Feelings of Loneliness Per Individual

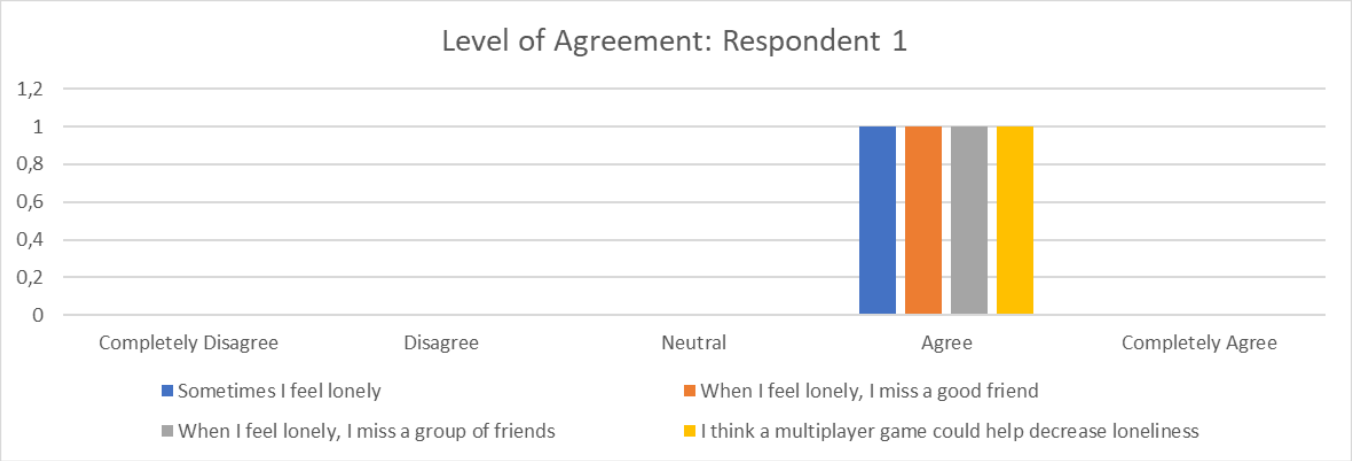

Figure 40: Bar graph loneliness. Level of agreement, respondent 1

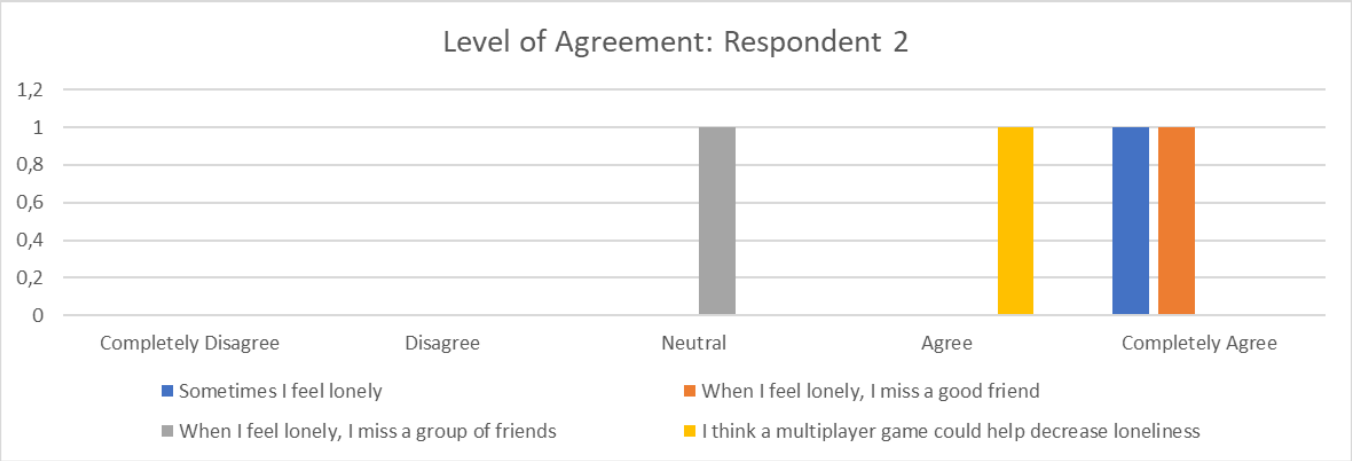

Figure 41: Bar graph loneliness. Level of agreement, respondent 2

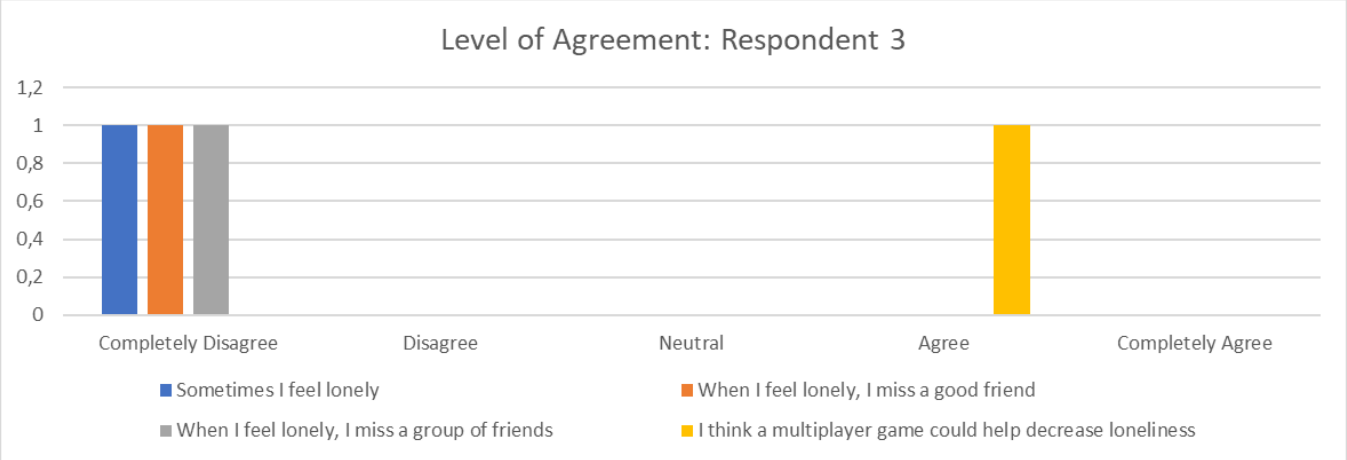

Figure 42: Bar graph loneliness. Level of agreement, respondent 3

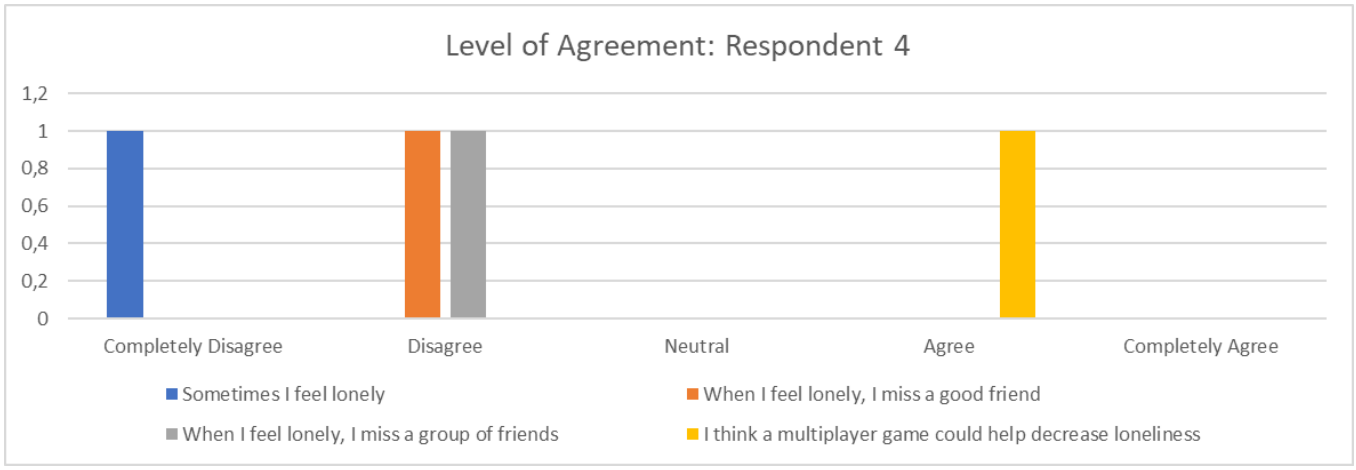

Figure 43: Bar graph loneliness. Level of agreement, respondent 4

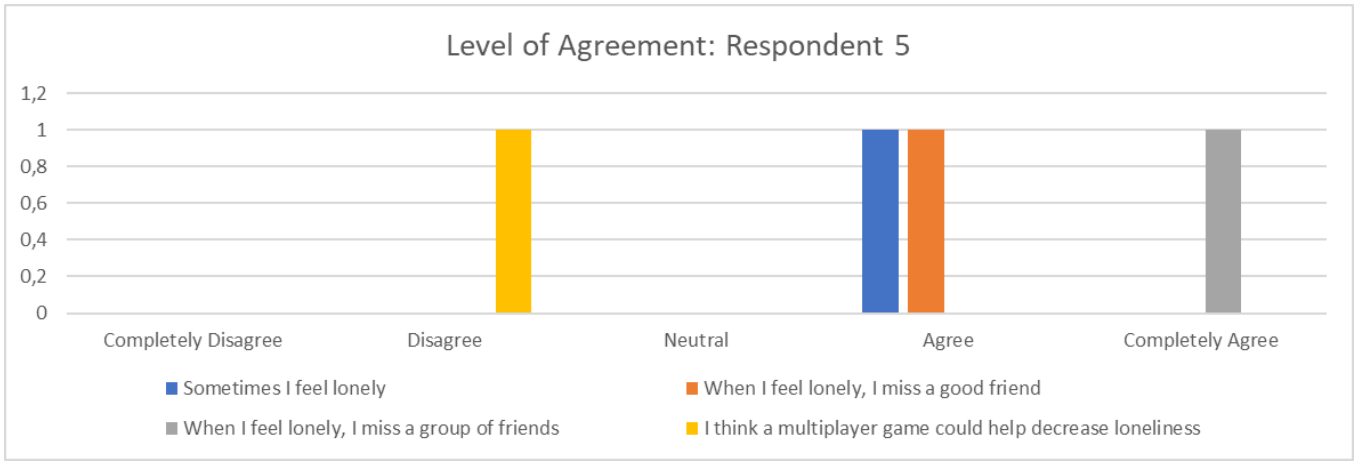

Figure 44: Bar graph loneliness. Level of agreement, respondent 5

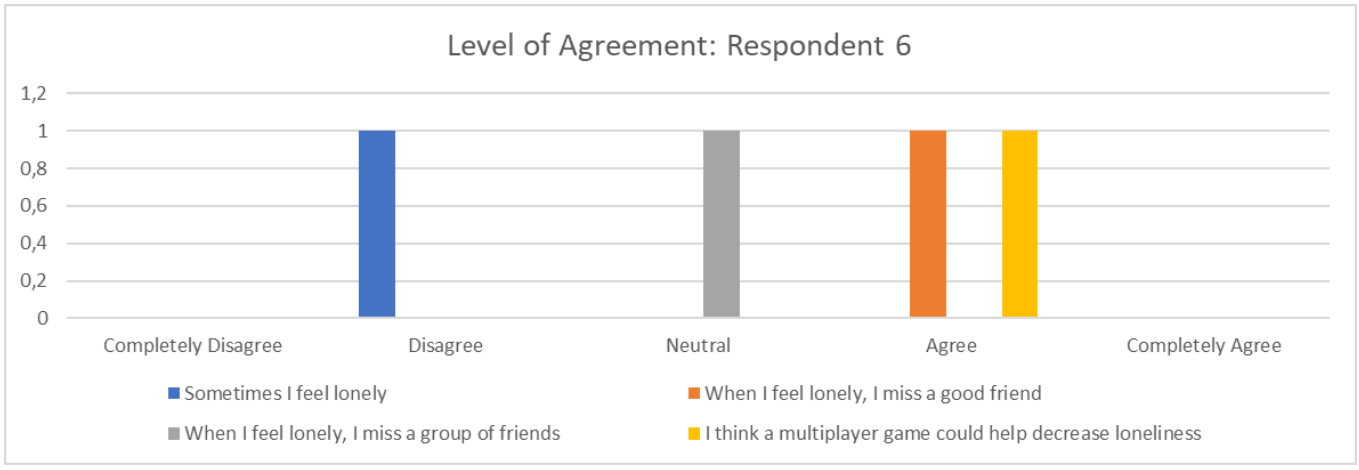

Figure 45: Bar graph loneliness. Level of agreement, respondent 6

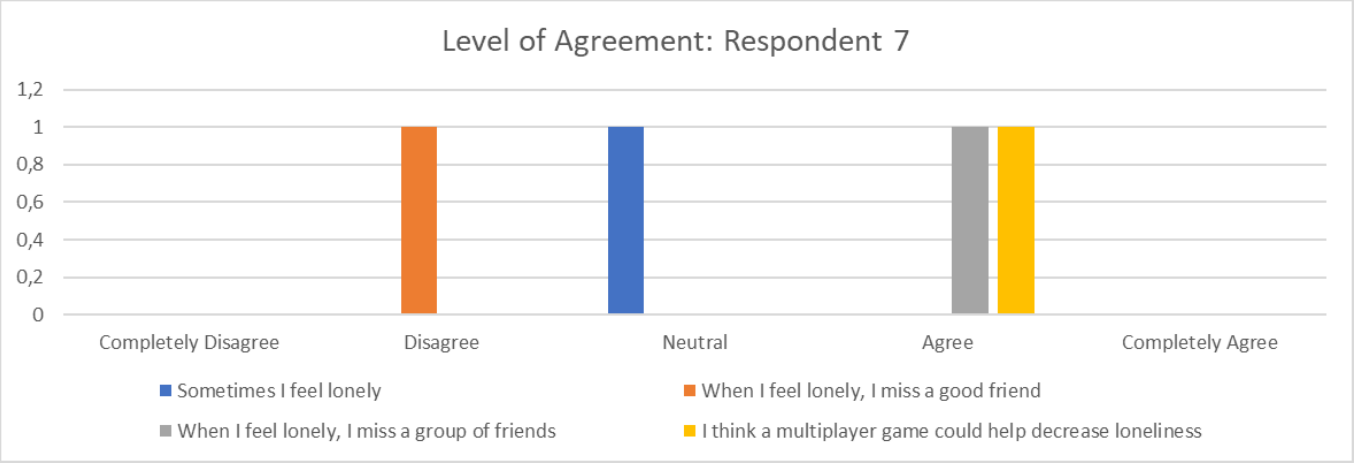

Figure 46: Bar graph loneliness. Level of agreement, respondent 7

Explanation before playing the game:

In this prototype, two players can play the digital hospital game. One player moves using the arrow keys while the other player moves using WASD. In the actual game, an online aspect will be added. This way, hospitalized children can play the game with friends who are at home.

In this prototype, each room is designed with the same features and the same environment. In the actual game, each room will represent a different area of the hospital. For example, a children's ward or an operation room.

Let interviewees play the game

Likert Scale Questions. These questions are on a scale from 1-5. 1 = completely disagree and 5 = completely agree

The explanation as given by the nurse is clear enough to understand how to play

The difficulty of the game rises with each level

Educational elements could be a nice addition to the game

If I were a child aged 5-10, the game would be fun to play with a friend

Loneliness

If the game were an online game, do you think a chat box would be a nice addition? Why, or why not?

Why do you/do you not think this game will help to reduce the loneliness that hospitalized children are experiencing?

Addiction

The actual game keeps track on how long the game has been played. The character will mention he is tired if the child has played for over two hours. The child will not be able to play any more after this. After x hours, the timer resets and the child can play again. Do you think this measure will help decrease the chances of a child getting addicted, why or why not?

The game keeps track on the current time, if it is after 8PM, the game cannot be played. This to discourage a child to play into the night. Do you think this measure will help decreasing the chances of a child getting addicted, why or why not?

What other measures can be taken to decrease the chances of a child getting addicted to this digital multiplayer game?

.

Other

What elements of the game did you like?

What elements of the game did you dislike?

What can be improved?

General Information

What is your age?

What is your gender?

Likert Scale Questions. These questions are on a scale from 1-5. 1 = completely disagree and 5 = completely agree

The explanation as given by the nurse is clear enough to understand how to play

4

Suggestion: Add a thought cloud or exclamation point so the child knows to speak to the nurse.

The difficulty of the game rises with each level

5, adding a challenge is good.

Educational elements could be a nice addition to the game

5

If I were a child aged 5-10, the game would be fun to play with a friend

5

Loneliness

If the game were an online game, do you think a chat box would be a nice addition? Why, or why not?

I think a chat function would be a nice addition. I can't imagine children using Skype or Discord to interact with each other, so a chat function would be ideal

Why do you/do you not think this game will help to reduce the loneliness that hospitalized children are experiencing?

I think that this game is a real nice addition to reduce loneliness. The multiplayer aspect gives children the chance to play with each other which offers interaction.

Addiction

The actual game keeps track on how long the game has been played. The character will mention he is tired if the child has played for over two hours. The child will not be able to play any more after this. After x hours, the timer resets and the child can play again. Do you think this measure will help decrease the chances of a child getting addicted, why or why not?

I think this is a really creative solution which I think can really help.

The game keeps track on the current time, if it is after 8PM, the game cannot be played. This to discourage a child to play into the night. Do you think this measure will help decreasing the chances of a child getting addicted, why or why not?

Yes I think this can help as well! If you start the game and you can see that the character is still sleeping, you already know that you cant play anymore.

What other measures can be taken to decrease the chances of a child getting addicted to this digital multiplayer game?

The combination of the two ideas would be of great help if you ask me. Moreover, if the multiplayer aspect of the game is being promoted this might help as well. Because if you play a single player game then you are at risk to get addicted but I think that if you play with others the chances of getting addicted decrease as well.

Other

What elements of the game did you like?

I like the concept as well as how the game looks.

What elements of the game did you dislike?

I really think that some elements should be added to make it clear that you need to interact with the nurse.

What can be improved?

Maybe the levels can be filled up more. And adding some sort of transition in between the scenes because right now you instantly move to next scene which is a bit abrupt.

General Information

What is your age?

18

What is your gender?

Male

Explanation before playing the game:

Likert Scale Questions. These questions are on a scale from 1-5. 1 = completely disagree and 5 = completely agree

The explanation as given by the nurse is clear enough to understand how to play

5

The difficulty of the game rises with each level

4

Educational elements could be a nice addition to the game

1, there is nothing wrong with a game that is just for fun, there is no need to implement educational elements

If I were a child aged 5-10, the game would be fun to play with a friend

5

Loneliness

If the game were an online game, do you think a chat box would be a nice addition? Why, or why not?

I am old-fashioned and I never chat. But would it be an addition for children? I think so, my son chats a lot so I think a chat box would be a nice addition.

Why do you/do you not think this game will help to reduce the loneliness that hospitalized children are experiencing?

Yes I think so, even if it were to be distracted.

Addiction

The actual game keeps track on how long the game has been played. The character will mention he is tired if the child has played for over two hours. The child will not be able to play any more after this. After x hours, the timer resets and the child can play again. Do you think this measure will help decrease the chances of a child getting addicted, why or why not?

Yes definitely, this would really help. Maybe two hours is too much.

The game keeps track on the current time, if it is after 8PM, the game cannot be played. This to discourage a child to play into the night. Do you think this measure will help decreasing the chances of a child getting addicted, why or why not?

I think even half past 8 is a good time. Let the character sleep because the child should be asleep as well. It's a good idea.

What other measures can be taken to decrease the chances of a child getting addicted to this digital multiplayer game?

Not really.

Other

What elements of the game did you like?

I like the initiative. It is a nice character and it is precisely what you expect with pixel art. It brings up nice memories from games I used to play.

What elements of the game did you dislike?

The game is really grey.

What can be improved?

The game is really quiet. Maybe you could add some background music or other sound effects.

General Information

What is your age?

52

What is your gender?

Male

Likert Scale Questions. These questions are on a scale from 1-5. 1 = completely disagree and 5 = completely agree

The explanation as given by the nurse is clear enough to understand how to play

I personally missed the explanation, but intuitively you already know how to play the game. Children aged 7+ already know how to read or maybe you can use oral explanation.

The difficulty of the game rises with each level

Yes I think the game elements get harder with each level.

Educational elements could be a nice addition to the game

It would be a nice addition. You have to take into account that children aged 5 have other abilities than children aged 10+. But maybe the game can increase with difficulty according to previous answers.

If I were a child aged 5-10, the game would be fun to play with a friend

I think so

Loneliness

If the game were an online game, do you think a chat box would be a nice addition? Why, or why not?

I definitely think so. This way the focus will lie even more on the social aspect of the game. Maybe even nurses and other hospital staff can join the chat.

Why do you/do you not think this game will help to reduce the loneliness that hospitalized children are experiencing?

I definitely think so. You are actively having contact with others and this game helps to distract you. However, maybe a bad thing about the game is that children don't want to have physical contact anymore, because they can just play the game to keep in touch.

Addiction

The actual game keeps track on how long the game has been played. The character will mention he is tired if the child has played for over two hours. The child will not be able to play any more after this. After x hours, the timer resets and the child can play again. Do you think this measure will help decrease the chances of a child getting addicted, why or why not?

Definitely. The elements in this game are not a risk for addiction. For example with Fortnite you play for 15 minutes and then play again.

The game keeps track on the current time, if it is after 8PM, the game cannot be played. This to discourage a child to play into the night. Do you think this measure will help decreasing the chances of a child getting addicted, why or why not?

Yes this would help as well.

What other measures can be taken to decrease the chances of a child getting addicted to this digital multiplayer game?

You can add mission cooldowns or something. That you cannot go to the operation room because it is occupied or you cannot use the wheelchair because it needs to be charged.

Other

What elements of the game did you like?

I really like the characters and that the hospital is like a maze with the hallways and stuff.

What elements of the game did you dislike?

Well the game can always be more pretty. Also there were no sounds and no way to know how many stethos were collected.

> The among of stethos collected was shown at the top right and top left corner of the screen.
>
> *Oh I completely missed that. Maybe you should move them. You can also add some kind of text in the middle saying "got it" or something.*

What can be improved?

Combining the text with pictures. Like this: collect the 3x [picture of stetho].

General Information

What is your age?

41

What is your gender?

Man

Likert Scale Questions. These questions are on a scale from 1-5. 1 = completely disagree and 5 = completely agree

The explanation as given by the nurse is clear enough to understand how to play

5

The difficulty of the game rises with each level

4

Educational elements could be a nice addition to the game

4, educational elements would be a nice addition. But there are always risks. For example if you add arithmetical elements and children dislike arithmetic, they wont play the game anymore.

If I were a child aged 5-10, the game would be fun to play with a friend

5

Loneliness

If the game were an online game, do you think a chat box would be a nice addition? Why, or why not?

I am not that experienced with playing games, so I would think that if you are playing the game you can't chat. I would prefer to talk rather than to chat.

Why do you/do you not think this game will help to reduce the loneliness that hospitalized children are experiencing?

Definitely. Maybe you can make the game real life with the actual hospital environment and that you can visit other children that are in the hospital.

But then you cant play the game with friends who are at home?

No but the children can think of ways to keep in contact with their friends from home.

The sound effects were clear, but I did not see the stethoscopes in the top corners.

Addiction

The actual game keeps track on how long the game has been played. The character will mention he is tired if the child has played for over two hours. The child will not be able to play any more after this. After x hours, the timer resets and the child can play again. Do you think this measure will help decrease the chances of a child getting addicted, why or why not?

Yes this is a nice idea. The hospital cannot offer a game that will cause children to get addicted. If this element is added to the game, addiction can be prevented.

The game keeps track on the current time, if it is after 8PM, the game cannot be played. This to discourage a child to play into the night. Do you think this measure will help decreasing the chances of a child getting addicted, why or why not?

I don't know really. What if you are awake due to the weird sleeping schedule that hospitalized children follow. If you need to take medication or something at night and you are awake, you want to play the game. But not after 1AM, then the children should go to sleep.

What other measures can be taken to decrease the chances of a child getting addicted to this digital multiplayer game?

Put the whole game on a cooldown for specific periods of time. But I guess that's just a combination of the two ideas that you came up with.

Other

Were the sound effect hints clear?

I liked the sound effects! There was a fun background music and the sound effects were a nice addition.

What elements of the game did you like?

I really liked the game was created t represent a hospital environment. There were nice elements such as the stethoscopes and stuff.

What elements of the game did you dislike?

There was nothing to do in the hallways.

What can be improved?

Add achievements and unlock outfits. Or maybe the characters can go outside?

General Information

What is your age?

22

What is your gender?

Female

Likert Scale Questions. These questions are on a scale from 1-5. 1 = completely disagree and 5 = completely agree

The explanation as given by the nurse is clear enough to understand how to play

5

The difficulty of the game rises with each level

1, it was not too hard because there was a clear explanation

Educational elements could be a nice addition to the game

4

If I were a child aged 5-10, the game would be fun to play with a friend

4

Loneliness

If the game were an online game, do you think a chat box would be a nice addition? Why, or why not?

I would prefer to call with friends I think.

Why do you/do you not think this game will help to reduce the loneliness that hospitalized children are experiencing?

Yes for sure. This game enables you to play with friends. You don't have to see each other but you see the other character's movement, you know there is someone there.

Addiction

The actual game keeps track on how long the game has been played. The character will mention he is tired if the child has played for over two hours. The child will not be able to play any more after this. After x hours, the timer resets and the child can play again. Do you think this measure will help decrease the chances of a child getting addicted, why or why not?

I think this would help because this way you are parenting the child without it being too obvious.

The game keeps track on the current time, if it is after 8PM, the game cannot be played. This to discourage a child to play into the night. Do you think this measure will help decreasing the chances of a child getting addicted, why or why not?

I can imagine a child waking up in the night and wanting to play in the evening. But maybe the time can be adjusted to midnight or something.

What other measures can be taken to decrease the chances of a child getting addicted to this digital multiplayer game?

Enable easy achievements. Then if children say "just one more achievement", this is easily done without taking up too much time.

Other

Were the sound effect hints clear?

Yes

What elements of the game did you like?

The game elements are really accessible for children. Not too much blood and stuff. It really is a nice game for children.

What elements of the game did you dislike?

The game is really grey. And the missions were too easy.

What can be improved?

Move down the stethoscope counter because it was hard to see.

General Information

What is your age?

21

What is your gender?

Female

Likert Scale Questions. These questions are on a scale from 1-5. 1 = completely disagree and 5 = completely agree

The explanation as given by the nurse is clear enough to understand how to play

5

The difficulty of the game rises with each level

4

Educational elements could be a nice addition to the game

5

If I were a child aged 5-10, the game would be fun to play with a friend

5

Loneliness

If the game were an online game, do you think a chat box would be a nice addition? Why, or why not?

I think so! But not if creepy man can chat as well. Just your friends.

Why do you/do you not think this game will help to reduce the loneliness that hospitalized children are experiencing?

Yes I think so! Even more if there is an option to chat, that way you are together while not actually being together. You know someone is playing a game with you and that gives you a sense of connection.

Addiction

The actual game keeps track on how long the game has been played. The character will mention he is tired if the child has played for over two hours. The child will not be able to play any more after this. After x hours, the timer resets and the child can play again. Do you think this measure will help decrease the chances of a child getting addicted, why or why not?

Yes a really nice idea, this way you tell the children to stop but in a subtle way.

The game keeps track on the current time, if it is after 8PM, the game cannot be played. This to discourage a child to play into the night. Do you think this measure will help decreasing the chances of a child getting addicted, why or why not?

This would help as well otherwise children will play all night. I used to sneak in my Nintendo DS and I would play all night.

What other measures can be taken to decrease the chances of a child getting addicted to this digital multiplayer game?

Nothing comes to mind.

Other

Were the sound effect hints clear?

Yes, I think the door sound especially helped because otherwise I would not have known to go to the door. Like, I would have missed that the door opened.

What elements of the game did you like?

I really liked that the characters were created via pixelart. It is a bit old school. Oh and you added some posters in the hallway, that was a nice addition as well. And I liked the game in the second room that you had to stand on the squares.

What elements of the game did you dislike?

Sometimes the character didn't respond.

What can be improved?

Maybe you could add more chambers and more challenges.

General Information

What is your age?

21

What is your gender?

Female

Likert Scale Questions. These questions are on a scale from 1-5. 1 = completely disagree and 5 = completely agree

The explanation as given by the nurse is clear enough to understand how to play

5

The difficulty of the game rises with each level

4

Educational elements could be a nice addition to the game

5, there is a nice challenge.

If I were a child aged 5-10, the game would be fun to play with a friend

5

Loneliness

If the game were an online game, do you think a chat box would be a nice addition? Why, or why not?

Yes, children are then able to communicate.

Why do you/do you not think this game will help to reduce the loneliness that hospitalized children are experiencing?

I think so! It is a really nice idea to familiarize children with the hospital environment in the form of a game. And I think it helps that your friends and family would join the environment that you are experiencing.

Addiction

The actual game keeps track on how long the game has been played. The character will mention he is tired if the child has played for over two hours. The child will not be able to play any more after this. After x hours, the timer resets and the child can play again. Do you think this measure will help decrease the chances of a child getting addicted, why or why not?

I think so. Maybe two hours is too much, I would go for 1 hour max. And I think it is of importance to let the character sleep instead of bluntly saying you have played too much.

The game keeps track on the current time, if it is after 8PM, the game cannot be played. This to discourage a child to play into the night. Do you think this measure will help decreasing the chances of a child getting addicted, why or why not?

This is also a nice idea. Maybe the hospitals can take the tablets when it is nighttime. But it is definitely smart to add something like this because otherwise children would play all night.

What other measures can be taken to decrease the chances of a child getting addicted to this digital multiplayer game?

Maybe the character could have energy levels which decrease as you play the game. And that the energy levels can increase if the character is sleeping. Or overall game cooldowns. Or maybe you can couple the time and the in-game time, then children can learn how to read the time.

Other

Were the sound effect hints clear?

I really liked the background music in the menu. And the sound effects were nice.

What elements of the game did you like?

It is a nice addition to have to go to the nurse. To learn in such a fun way that you can go the the nurse for explanations and stuff. And I liked that you had to collect stethoscopes, that it is medical equipment. And that the characters had different colours.

What elements of the game did you dislike?

It wasn't clear if one character or both characters needed to walk through the door.

What can be improved?

Add something to do in the hallway. Or minigames

General Information

What is your age?

21

What is your gender?

Female

Likert Scale Questions. These questions are on a scale from 1-5. 1 = completely disagree and 5 = completely agree

The explanation as given by the nurse is clear enough to understand how to play

5

The difficulty of the game rises with each level

5

Educational elements could be a nice addition to the game

5

If I were a child aged 5-10, the game would be fun to play with a friend

5

Loneliness

If the game were an online game, do you think a chat box would be a nice addition? Why, or why not?

I think so, maybe with a chat box the children can communicate more. And I don't think that children use skype or something to communicate, so a chat box would suffice.

Why do you/do you not think this game will help to reduce the loneliness that hospitalized children are experiencing?

I definitely think so. Some type of game is always fun for children and especially if children can play that with their friends or family. If you play a game with friends you may feel less lonely because you know there is someone for you with whom you can play the game.

Addiction

The actual game keeps track on how long the game has been played. The character will mention he is tired if the child has played for over two hours. The child will not be able to play any more after this. After x hours, the timer resets and the child can play again. Do you think this measure will help decrease the chances of a child getting addicted, why or why not?

I like this idea. I think about 1 hour or 1,5 hour is fine. It is also a nice idea to let the character sleep instead of bluntly saying you have played too much already.

The game keeps track on the current time, if it is after 8PM, the game cannot be played. This to discourage a child to play into the night. Do you think this measure will help decreasing the chances of a child getting addicted, why or why not?

I think so, children should be discouraged to play all night.

What other measures can be taken to decrease the chances of a child getting addicted to this digital multiplayer game?

I can think of something really.

Other

Were the sound effect hints clear?

The sound effects were helping me to know that I picked up items or activated the door and stuff. And I really liked the background music, it was really relaxing.

What elements of the game did you like?

I liked the hospital environment and the character was really fun with pixelart and stuff.

What elements of the game did you dislike?

Uh well the game is a bit grey, and there are only three levels so the game is a bit short.

What can be improved?

For this prototype I can only think of the stethoscopes that need to be moved. But in the definite version of the game there are more things that can be added such as achievements and such!

General Information

What is your age?

22

What is your gender?

Female

The explanation as given by the nurse is clear enough to understand how to play

Yes, the explanation was clear.

Yes, I thought so too.

Educational elements could be a nice addition to the game

Yes, that would be nice

Yes, I think so as well

The game would be fun to play with a friend

Yes, very much! I would like to play this game again

Yeah, me too.

Loneliness

If the game were an online game, do you think a chat box would be a nice addition? Why, or why not?

It would be nice to be able to communicate. A chat box is fine but maybe calling would be more effective.

Yes, I think so too.

Why do you/do you not think this game will help to reduce the loneliness that hospitalized children are experiencing?

Yes, I think so because you can do something together.

Yes

Other

What elements of the game did you like?

De poppetjes vond ik wel heel leuk. En de opdrachten waren heel leuk.

Dat je met de poppetjes ergens heen kon lopen en door de deur kon lopen.

Would it be a nice addition if you could create your own character?

Yes, that would be really nice

Yes, I think so too

What elements of the game did you dislike?

Nothing, I thought everything was nice

Yeah

What can be improved?

-

General Information

What is your age?

10

8

What is your gender?

Female

Female

```
using System.Collections;
using System.Collections.Generic;
using UnityEngine;

public class CongratulationsSFX : MonoBehaviour
{
    [SerializeField] AudioClip congratulationsSFX;

    // Start is called before the first frame update
    void Start()
    {
        AudioSource.PlayClipAtPoint(congratulationsSFX,
Camera.main.transform.position);
    }
}
```

```
using System.Collections;
using System.Collections.Generic;
using UnityEngine;
using UnityEngine.SceneManagement;

public class Menu : MonoBehaviour
{

    public void StartFirstLevel()
    {
        SceneManager.LoadScene(1);
    }

    public void StartTegenElkaarGame()
    {
        //Load next scene for gameplay Tegen Elkaar
    }

    public void ExitGame()
    {
        Application.Quit();
    }

    public void PlayGameAgain()
    {
        SceneManager.LoadScene(0);
    }
}
```

```
using System.Collections;
using System.Collections.Generic;
using UnityEngine;

public class MusicClass : MonoBehaviour
{
    private AudioSource backgroundMusic;
    private bool musicIsPlaying = false;
```

```
    private void Awake()
    {
        DontDestroyOnLoad(transform.gameObject);
        backgroundMusic = GetComponent<AudioSource>();
    }

    public void PlayMusic()
    {
        if (musicIsPlaying)
        {
            backgroundMusic.Play();
        }
    }
}
```

```
using System.Collections;
using System.Collections.Generic;
using UnityEngine;

public class MusicMenu : MonoBehaviour
{
    private AudioSource menuMusic;

    private void Awake()
    {
        menuMusic = GetComponent<AudioSource>();
    }

    private void Start()
    {
        Destroy(GameObject.Find("Music"));
    }

    public void PlayMenuMusic()
    {
        if (menuMusic.isPlaying)
        {
            menuMusic.Play();
        }
    }
}
```

```
using System.Collections;
using System.Collections.Generic;
using UnityEngine;
using UnityStandardAssets.CrossPlatformInput;

public class Player1Movement : MonoBehaviour
{

    public float moveSpeed = 5f;


    [SerializeField] Animator myAnimator;
    [SerializeField] Rigidbody2D myRigidBody;
```

```
    Vector2 movement;


    private void Start()
    {
        myRigidBody = GetComponent<Rigidbody2D>();
        myAnimator = GetComponent<Animator>();
    }

    void Update()
    {
        Move();
    }

    private void Move()
    {
        movement.x = CrossPlatformInputManager.GetAxis("Horizontal");
        movement.y = CrossPlatformInputManager.GetAxis("Vertical");

        myAnimator.SetFloat("Horizontal", movement.x);
        myAnimator.SetFloat("Vertical", movement.y);
        myAnimator.SetFloat("Speed", movement.sqrMagnitude);
    }


    void FixedUpdate()
    {
        myRigidBody.MovePosition(myRigidBody.position + movement * moveSpeed *
Time.fixedDeltaTime);
    }
}
```

```
using System.Collections;
using System.Collections.Generic;
using UnityEngine;
using UnityStandardAssets.CrossPlatformInput;

public class Player2Movement : MonoBehaviour
{

    public float moveSpeed = 5f;


    [SerializeField] Animator myAnimator;
    [SerializeField] Rigidbody2D myRigidBody;
    Vector2 movement;


    private void Start()
    {
        myRigidBody = GetComponent<Rigidbody2D>();
        myAnimator = GetComponent<Animator>();
    }

    void Update()
    {
        Move();
    }

    private void Move()
```

```
    {
        //Movement for input
        movement.x = CrossPlatformInputManager.GetAxis("Horizontal2");
        movement.y = CrossPlatformInputManager.GetAxis("Vertical2");

        //Animate when moving
        myAnimator.SetFloat("Horizontal2", movement.x);
        myAnimator.SetFloat("Vertical2", movement.y);
        myAnimator.SetFloat("Speed2", movement.sqrMagnitude);
    }


    void FixedUpdate()
    {
        myRigidBody.MovePosition(myRigidBody.position + movement * moveSpeed *
Time.fixedDeltaTime);
    }
}
```

```
using System.Collections;
using System.Collections.Generic;
using UnityEngine;
using UnityEngine.SceneManagement;

public class SceneLoader : MonoBehaviour
{
    public Animator animator;

    public void LoadNextScene()
    {
        int currentSceneIndex = SceneManager.GetActiveScene().buildIndex;
        SceneManager.LoadScene(currentSceneIndex + 1);
    }

    public void LoadStartScene()
    {
        SceneManager.LoadScene(0);
    }

    public void QuitGame()
    {
        Application.Quit();
    }

    public void FadeToLevel(int levelIndex)
    {
        animator.SetTrigger("FadeOut");
    }
}
```

```
using System.Collections;
using System.Collections.Generic;
using UnityEngine;
using UnityEngine.SceneManagement;
using UnityEngine.UI;
using TMPro;
```

```
public class TextInUIBoth : MonoBehaviour
{
    [SerializeField] TextMeshProUGUI stethosPinkText;
    [SerializeField] TextMeshProUGUI stethosBlueText;
    [SerializeField] int totalPinkStethoScore = 0;
    [SerializeField] int totalBlueStethoScore = 0;
    [SerializeField] Image pinkStethoImage;
    [SerializeField] Image blueStethoImage;
    [SerializeField] Image exclamationPoint;

    bool stethosActivated = false;

    private void Start()
    {
        pinkStethoImage.enabled = false;
        blueStethoImage.enabled = false;
        stethosPinkText.enabled = false;
        stethosBlueText.enabled = false;
        exclamationPoint.enabled = true;
    }

    public void StethosActivated()
    {
        stethosActivated = true;
        pinkStethoImage.enabled = true;
        blueStethoImage.enabled = true;
        stethosBlueText.enabled = true;
        stethosPinkText.enabled = true;

    }

    //Stop displaying exclamation point cloud
    public void disableCloud()
    {
        exclamationPoint.enabled = false;
    }

    //Display number of pink stethos that are collected
    public void AddPinkStethosToScore(int numberPinksToAdd)
    {
        if (stethosActivated)
        {
            totalPinkStethoScore += numberPinksToAdd;
            stethosPinkText.text = totalPinkStethoScore.ToString() + "x";
        }
    }
    //Display number of blue stethos that are collected
    public void AddBlueStethosToScore(int numberBluesToAdd)
    {
        if (stethosActivated)
        {
            totalBlueStethoScore += numberBluesToAdd;
            stethosBlueText.text = totalBlueStethoScore.ToString() + "x";
        }
    }
}
```

```
using System.Collections;
using System.Collections.Generic;
using UnityEngine;
using UnityEngine.SceneManagement;
using UnityEngine.UI;
using TMPro;

public class TextInUISquareScene : MonoBehaviour
{
    [SerializeField] Image explanationCloudImage1;
    [SerializeField] Image explanationCloudImage2;
    [SerializeField] Image explanationCloudImage3;
    [SerializeField] Image explanationCloudImage4;
    [SerializeField] Image explanationCloudImage5;
    [SerializeField] Image exclamationPoint;

    bool squaresActivated = false;

    private void Start()
    {
        ExplanationCloudDisbale();
    }

    public void StethosActivated()
    {
        ExplanationCloudEnable();
    }

    //Enable the UI elements
    public void ExplanationCloudEnable()
    {
        explanationCloudImage1.enabled = true;
        explanationCloudImage2.enabled = true;
        explanationCloudImage3.enabled = true;
        explanationCloudImage4.enabled = true;
        explanationCloudImage5.enabled = true;
        exclamationPoint.enabled = false;
    }
    //Disable the UI elements
    public void ExplanationCloudDisbale()
    {
        explanationCloudImage1.enabled = false;
        explanationCloudImage2.enabled = false;
        explanationCloudImage3.enabled = false;
        explanationCloudImage4.enabled = false;
        explanationCloudImage5.enabled = false;
        exclamationPoint.enabled = true;
    }

}
```

```
using System.Collections;
using System.Collections.Generic;
using UnityEngine;
using UnityEngine.SceneManagement;
using UnityEngine.UI;
using TMPro;

public class TextInUIStethoScene : MonoBehaviour
{
```

```
    [SerializeField] TextMeshProUGUI stethosPinkText;
    [SerializeField] TextMeshProUGUI stethosBlueText;
    [SerializeField] int totalPinkStethoScore = 0;
    [SerializeField] int totalBlueStethoScore = 0;
    [SerializeField] Image pinkStethoImage;
    [SerializeField] Image blueStethoImage;
    [SerializeField] Image ExclamationPointImage;
    [SerializeField] TextMeshProUGUI explanationCloudImage1;
    [SerializeField] Image explanationCloudImage2;
    [SerializeField] Image explanationCloudImage3;
    [SerializeField] Image explanationCloudImage4;
    [SerializeField] Image explanationCloudImage5;
    [SerializeField] Image explanationCloudImage6;

    bool stethosActivated = false;

    private void Start()
    {
        pinkStethoImage.enabled = false;
        blueStethoImage.enabled = false;
        stethosPinkText.enabled = false;
        stethosBlueText.enabled = false;
        ExplanationCloudDisbale();
    }

    public void StethosActivated()
    {
        stethosActivated = true;
        pinkStethoImage.enabled = true;
        blueStethoImage.enabled = true;
        stethosBlueText.enabled = true;
        stethosPinkText.enabled = true;
        ExplanationCloudEnable();
    }

    //Display number of pink stethos that are collected
    public void AddPinkStethosToScore(int numberPinksToAdd)
    {
        if (stethosActivated)
        {
            totalPinkStethoScore += numberPinksToAdd;
            stethosPinkText.text = totalPinkStethoScore.ToString() + "x";
        }
    }
    //Display number of blue stethos that are collected
    public void AddBlueStethosToScore(int numberBluesToAdd)
    {
        if (stethosActivated)
        {
            totalBlueStethoScore += numberBluesToAdd;
            stethosBlueText.text = totalBlueStethoScore.ToString() + "x";
        }
    }
    //Enable the UI elements
    public void ExplanationCloudEnable()
    {
        explanationCloudImage1.enabled = true;
        explanationCloudImage2.enabled = true;
        explanationCloudImage3.enabled = true;
        explanationCloudImage4.enabled = true;
        explanationCloudImage5.enabled = true;
        explanationCloudImage6.enabled = true;
```

```
        ExclamationPointImage.enabled = false;
    }
    //Disable the UI elements
    public void ExplanationCloudDisbale()
    {
        explanationCloudImage1.enabled = false;
        explanationCloudImage2.enabled = false;
        explanationCloudImage3.enabled = false;
        explanationCloudImage4.enabled = false;
        explanationCloudImage5.enabled = false;
        explanationCloudImage6.enabled = false;
        ExclamationPointImage.enabled = true;
    }

}
```

```
using System.Collections;
using System.Collections.Generic;
using UnityEngine;

public class Stethoscope : MonoBehaviour
{


    [SerializeField] AudioClip stethosPickUpSFX;
    [SerializeField] int scoreOfAStetho = 1;
    [SerializeField] Sprite[] showStethoPink;
    [SerializeField] Sprite[] showStethoBlue;
    [SerializeField] bool spritesChangedToVisible = false;

    LevelExit levelExit;
    TextInUIStethoScene textInUIStethoScene;


    private void Start()
    {
        CountNumberOfStethosToCollect();
        textInUIStethoScene = FindObjectOfType<TextInUIStethoScene>();
    }

    //If a stetho has tag "Stetho X", this item needs to be collected
    private void CountNumberOfStethosToCollect()
    {
        //Send numer of collectable stethos (both blue and pink) to class LevelExit
        levelExit = FindObjectOfType<LevelExit>();
        if (tag == "Stetho Pink")
        {
            levelExit.CountPinkStethos();
        }
        if(tag == "Stetho Blue")
        {
            levelExit.CountBlueStethos();
        }
    }

    //Go through all methods when called upon (when interaction with nurse)
    public void ChangeSpritesToVisible()
    {
```

```
        CheckStethoTagPink();
        CheckStethoTagBlue();
        SpriteIsVisible();
        textInUIStethoScene.StethosActivated();
    }

    //Change all pink stethos to render visible
    public void CheckStethoTagPink()
    {
        if(tag == "Stetho Pink")
        {
            GetComponent<SpriteRenderer>().sprite = showStethoPink[0];
        }
    }

    //Change all blue stethos to render visible
    public void CheckStethoTagBlue()
    {
        if (tag == "Stetho Blue")
        {
            GetComponent<SpriteRenderer>().sprite = showStethoBlue[0];
        }
    }

    //Set boolean for all visible sprites as true
    public void SpriteIsVisible()
    {
        spritesChangedToVisible = true;
    }


    //Destroy pink stethos
    private void DestroyPinkStetho()
    {
        if (spritesChangedToVisible)
        {
            PlayDestroySoundEffect();
            Destroy(gameObject);
            levelExit.PinkStethosDestroyed();
            AddPinkToScoreUI();
        }
    }

    //Destroy blue stethos
    private void DestroyBlueStetho()
    {
        if (spritesChangedToVisible)
        {
            PlayDestroySoundEffect();
            Destroy(gameObject);
            levelExit.BlueStethosDestroyed();
            AddBlueToScoreUI();
        }
    }

    //Play sound effect if item is destroyed
    private void PlayDestroySoundEffect()
    {
        AudioSource.PlayClipAtPoint(stethosPickUpSFX, Camera.main.transform.position);
    }

    //Add pink Score to UI
```

```
    public void AddPinkToScoreUI()
    {
        FindObjectOfType<TextInUIStethoScene>().AddPinkStethosToScore(scoreOfAStetho);
    }

    //Add blue score to UI
    public void AddBlueToScoreUI()
    {
        FindObjectOfType<TextInUIStethoScene>().AddBlueStethosToScore(scoreOfAStetho);
    }

    //Trigger to check whether player collides with stetho
    private void OnTriggerEnter2D(Collider2D other)
    {
        if (other.tag == "Player 1" && tag == "Stetho Pink")
        {
            DestroyPinkStetho();
        }
        if (other.tag == "Player 2" && tag == "Stetho Blue")
        {
            DestroyBlueStetho();
        }
    }
}
```

```
using System.Collections;
using System.Collections.Generic;
using UnityEngine;

public class StethosScriptStethosAndSquares : MonoBehaviour
{


    [SerializeField] AudioClip stethosPickUpSFX;
    [SerializeField] int scoreOfAStetho = 1;
    [SerializeField] Sprite[] showStethoPink;
    [SerializeField] Sprite[] showStethoBlue;
    [SerializeField] bool spritesChangedToVisible = false;

    SquaresAndStethosExit squaresAndStethoExit;
    TextInUIBoth textInUIBoth;


    private void Start()
    {
        CountNumberOfStethosToCollect();
        textInUIBoth = FindObjectOfType<TextInUIBoth>();
    }

    //If a stetho has tag "Stetho X", this item needs to be collected
    private void CountNumberOfStethosToCollect()
    {
        //Send numer of collectable stethos (both blue and pink) to class LevelExit
        squaresAndStethoExit = FindObjectOfType<SquaresAndStethosExit>();
        if (tag == "Stetho Pink")
        {
            squaresAndStethoExit.CountPinkStethos();
        }
```

```
        if (tag == "Stetho Blue")
        {
            squaresAndStethoExit.CountBlueStethos();
        }
    }

    //Go through all methods when called upon (when interaction with squares)
    public void ChangeSpritesToVisible()
    {
        CheckStethoTagPink();
        CheckStethoTagBlue();
        SpriteIsVisible();
        textInUIBoth.StethosActivated();
    }

    //Change all pink stethos to render visible
    public void CheckStethoTagPink()
    {
        if (tag == "Stetho Pink")
        {
            GetComponent<SpriteRenderer>().sprite = showStethoPink[0];
        }
    }

    //Change all blue stethos to render visible
    public void CheckStethoTagBlue()
    {
        if (tag == "Stetho Blue")
        {
            GetComponent<SpriteRenderer>().sprite = showStethoBlue[0];
        }
    }

    //Set boolean for all visible sprites as true
    public void SpriteIsVisible()
    {
        spritesChangedToVisible = true;
    }


    //Destroy pink stethos
    private void DestroyPinkStetho()
    {
        if (spritesChangedToVisible)
        {
            PlayDestroySoundEffect();
            Destroy(gameObject);
            squaresAndStethoExit.PinkStethosDestroyed();
            AddPinkToScoreUI();
        }
    }

    //Destroy blue stethos
    private void DestroyBlueStetho()
    {
        if (spritesChangedToVisible)
        {
            PlayDestroySoundEffect();
            Destroy(gameObject);
            squaresAndStethoExit.BlueStethosDestroyed();
            AddBlueToScoreUI();
        }
```

```
    }

    //Play sound effect if item is destroyed
    private void PlayDestroySoundEffect()
    {
        AudioSource.PlayClipAtPoint(stethosPickUpSFX, Camera.main.transform.position);
    }

    //Add pink Score to UI
    public void AddPinkToScoreUI()
    {
        FindObjectOfType<TextInUIBoth>().AddPinkStethosToScore(scoreOfAStetho);
    }

    //Add blue score to UI
    public void AddBlueToScoreUI()
    {
        FindObjectOfType<TextInUIBoth>().AddBlueStethosToScore(scoreOfAStetho);
    }

    //Trigger to check whether player collides with stetho
    private void OnTriggerEnter2D(Collider2D other)
    {
        if (other.tag == "Player 1" && tag == "Stetho Pink")
        {
            DestroyPinkStetho();
        }
        if (other.tag == "Player 2" && tag == "Stetho Blue")
        {
            DestroyBlueStetho();
        }
    }
}
```

```
using System.Collections;
using System.Collections.Generic;
using UnityEngine;

public class Squares : MonoBehaviour
{
    [SerializeField] AudioClip squareInteractionSFX;
    [SerializeField] Color pinkColour;
    [SerializeField] Color blueColour;
    [SerializeField] bool coloursHaveChanged = false;

    LevelSquareExit levelSquareExit;

    private void Start()
    {
        levelSquareExit = FindObjectOfType<LevelSquareExit>();
    }

    //Display squares
    public void ChangeToVisible()
    {
        ChangeBlueSquareToVisible();
        ChangePinkSquareToVisible();
        coloursHaveChanged = true;
```

```
    }

    //Code behind display pink square
    public void ChangePinkSquareToVisible()
    {
        if (tag == "Square Pink")
        {
            GetComponent<SpriteRenderer>().color = pinkColour;
        }
    }
    //Code behind display blue square
    public void ChangeBlueSquareToVisible()
    {
        if (tag == "Square Blue")
        {
            GetComponent<SpriteRenderer>().color = blueColour;
        }
    }

    private void PinkSquareInteracted()
    {
        if (coloursHaveChanged)
        {
            levelSquareExit.PinkIsInteracted();
        }
    }

    private void BlueSquareInteracted()
    {
        if (coloursHaveChanged)
        {
            levelSquareExit.BlueIsInteracted();
        }
    }

    private void PinkSquareStopInteraction()
    {
        levelSquareExit.PinkStoppedInteracting();
    }

    private void BlueSquareStopInteraction()
    {
        levelSquareExit.BlueStoppedInteracting();
    }

    //check if players interact with square
    private void OnTriggerEnter2D(Collider2D other)
    {
        if (coloursHaveChanged && other.tag == "Player 1" && tag == "Square Pink")
        {
            AudioSource.PlayClipAtPoint(squareInteractionSFX,
Camera.main.transform.position);
            PinkSquareInteracted();
        }
        if (coloursHaveChanged && other.tag == "Player 2" && tag == "Square Blue")
        {
            AudioSource.PlayClipAtPoint(squareInteractionSFX,
Camera.main.transform.position);
            BlueSquareInteracted();
        }
    }
```

```
    //check if players stop interacting with square
    private void OnTriggerExit2D(Collider2D other)
    {
        if (other.tag == "Player 1" && tag == "Square Pink")
        {
            PinkSquareStopInteraction();
        }
        if (other.tag == "Player 2" && tag == "Square Blue")
        {
            BlueSquareStopInteraction();
        }
    }
}
```

```
using System.Collections;
using System.Collections.Generic;
using UnityEngine;

public class SquaresScriptStethosAndSquares : MonoBehaviour
{
    [SerializeField] Color pinkColour;
    [SerializeField] Color blueColour;
    [SerializeField] bool blueColourChanged = false;
    [SerializeField] bool pinkColourChanged = false;
    [SerializeField] AudioClip squareInteractionSceneBothSFX;

    SquaresAndStethosExit squaresAndStethosExit;

    private void Start()
    {
        squaresAndStethosExit = FindObjectOfType<SquaresAndStethosExit>();
    }

    //Display squares
    public void ChangeToVisible()
    {
        ChangeBlueSquareToVisible();
        ChangePinkSquareToVisible();
    }

    //Code behind display pink square
    public void ChangePinkSquareToVisible()
    {
        if (tag == "Square Pink")
        {
            GetComponent<SpriteRenderer>().color = pinkColour;
            pinkColourChanged = true;
        }
    }
    //Code behind display blue square
    public void ChangeBlueSquareToVisible()
    {
        if (tag == "Square Blue")
        {
            GetComponent<SpriteRenderer>().color = blueColour;
            blueColourChanged = true;
        }
    }
```

```
    private void PinkSquareInteracted()
    {
        squaresAndStethosExit.PinkIsInteracted();
    }

    private void BlueSquareInteracted()
    {
        squaresAndStethosExit.BlueIsInteracted();
    }

    private void PinkSquareStopInteraction()
    {
        squaresAndStethosExit.PinkStoppedInteracting();
    }

    private void BlueSquareStopInteraction()
    {
        squaresAndStethosExit.BlueStoppedInteracting();
    }

    //check if players interact with square
    private void OnTriggerEnter2D(Collider2D other)
    {
        if (other.tag == "Player 1" && tag == "Square Pink")
        {
            AudioSource.PlayClipAtPoint(squareInteractionSceneBothSFX,
Camera.main.transform.position);
            PinkSquareInteracted();
        }
        if (other.tag == "Player 2" && tag == "Square Blue")
        {
            AudioSource.PlayClipAtPoint(squareInteractionSceneBothSFX,
Camera.main.transform.position);
            BlueSquareInteracted();
        }
    }

    //check if players stop interacting with square
    private void OnTriggerExit2D(Collider2D other)
    {
        if (other.tag == "Player 1" && tag == "Square Pink")
        {
            PinkSquareStopInteraction();
        }
        if (other.tag == "Player 2" && tag == "Square Blue")
        {
            BlueSquareStopInteraction();
        }
    }
}
```

```
using System.Collections;
using System.Collections.Generic;
using UnityEngine;

public class NurseInteractionBoth : MonoBehaviour
{
```

```
    SquaresScriptStethosAndSquares[] squaresArray;
    TextInUIBoth textInUIBoth;
    [SerializeField] AudioClip nurseInteractionBothSFX;


    void Start()
    {
        squaresArray = FindObjectsOfType<SquaresScriptStethosAndSquares>();
        textInUIBoth = FindObjectOfType<TextInUIBoth>();
    }

    //When Player 1 or Player 2 collides with nurse, display squares
    private void OnTriggerEnter2D(Collider2D other)
    {
        if (other.tag == "Player 1" || other.tag == "Player 2")
        {
            AudioSource.PlayClipAtPoint(nurseInteractionBothSFX,
Camera.main.transform.position);
            foreach (SquaresScriptStethosAndSquares square in squaresArray)
            {
                square.ChangeToVisible();
                textInUIBoth.disableCloud();
            }

            this.gameObject.GetComponent<BoxCollider2D>().isTrigger = false;
        }
    }
}
```

```
using System.Collections;
using System.Collections.Generic;
using UnityEngine;

public class NurseInteractionSquareScene : MonoBehaviour
{
    Squares[] squaresArray;
    TextInUISquareScene textInUISquareScene;
    [SerializeField] AudioClip nurseInteractionSquareSceneSFX;


    void Start()
    {
        squaresArray = FindObjectsOfType<Squares>();
        textInUISquareScene = FindObjectOfType<TextInUISquareScene>();
    }

    //When Player 1 or Player 2 collides with nurse, display squares
    private void OnTriggerEnter2D(Collider2D other)
    {
        if (other.tag == "Player 1" || other.tag == "Player 2")
        {
            AudioSource.PlayClipAtPoint(nurseInteractionSquareSceneSFX,
Camera.main.transform.position);
            foreach (Squares square in squaresArray)
            {
                square.ChangeToVisible();
                textInUISquareScene.ExplanationCloudEnable();
            }
```

```
            this.gameObject.GetComponent<BoxCollider2D>().isTrigger = false;
        }
    }


}
```

```
using System.Collections;
using System.Collections.Generic;
using UnityEngine;

public class NurseInteractionStethoScene : MonoBehaviour
{
    Stethoscope[] stethoscopeArray;
    [SerializeField] AudioClip nurseInteractionStethoSceneSFX;

    void Start()
    {
        stethoscopeArray = FindObjectsOfType<Stethoscope>();
    }

    //When Player 1 or Player 2 collides with nurse, display stethos and UI text
    private void OnTriggerEnter2D(Collider2D other)
    {
        AudioSource.PlayClipAtPoint(nurseInteractionStethoSceneSFX,
Camera.main.transform.position);
        if (other.tag == "Player 1" || other.tag == "Player 2"){

            foreach (Stethoscope stetho in stethoscopeArray)
            {
                stetho.ChangeSpritesToVisible();
            }

            this.gameObject.GetComponent<BoxCollider2D>().isTrigger = false;
        }
    }
}
```

```
using System.Collections;
using System.Collections.Generic;
using UnityEngine;
using UnityEngine.SceneManagement;

public class LevelExit : MonoBehaviour
{


    [SerializeField] float LevelLoadDelay = 2f;
    [SerializeField] int pinkStethosToCollect;
    [SerializeField] int blueStethosToCollect;
    [SerializeField] bool allPinkStethosCollected = false;
    [SerializeField] bool allBlueStethosCollected = false;
    [SerializeField] bool allStethosCollected = false;
    [SerializeField] Sprite[] doorOpenOrClosed;
```

```
    [SerializeField] AudioClip openDoorSFX;

    SceneLoader sceneLoader;

    private void ShowNextDoorSprite()
    {
        GetComponent<SpriteRenderer>().sprite = doorOpenOrClosed[1];
        AudioSource.PlayClipAtPoint(openDoorSFX, Camera.main.transform.position);

    }

    //check door collider
    void OnTriggerEnter2D(Collider2D other)
    {
        //door will only open if all stethos are collected
        if (allStethosCollected) {
            sceneLoader = FindObjectOfType<SceneLoader>();
            sceneLoader.LoadNextScene();
        }
    }

    //keep track of begin amount of pink stethos
    public void CountPinkStethos()
    {
        pinkStethosToCollect++;
    }

    //keep track of begin amount of blue stethos
    public void CountBlueStethos()
    {
        blueStethosToCollect++;
    }

    //keep track of how many pink stethos are destroyed
    public void PinkStethosDestroyed()
    {
        pinkStethosToCollect--;
        //if there are no more pink stethos, all pink stethos are collected
        if(pinkStethosToCollect <= 0)
        {
            allPinkStethosCollected = true;
            if(allPinkStethosCollected && allBlueStethosCollected)
            {
                allStethosCollected = true;
                ShowNextDoorSprite();
            }
        }
    }

    //keep track of how many blue stethos are destroyed
    public void BlueStethosDestroyed()
    {
        blueStethosToCollect--;
        //if there are no more blue stethos, all blue stethos are collected
        if(blueStethosToCollect <= 0)
        {
            allBlueStethosCollected = true;
            if(allBlueStethosCollected && allPinkStethosCollected)
            {
                allStethosCollected = true;
                ShowNextDoorSprite();
            }
```

```
        }
    }
}
```

```
using System.Collections;
using System.Collections.Generic;
using UnityEngine;

public class LevelSquareExit : MonoBehaviour
{
    [SerializeField] bool pinkIsInteracted = false;
    [SerializeField] bool blueIsInteracted = false;
    [SerializeField] bool allIsInteracted = false;
    [SerializeField] bool forRealsiesAllInteracted = false;
    [SerializeField] Sprite[] doorOpenOrClosed;
    [SerializeField] AudioClip openDoorSFX;
    private bool soundEffectHasPlayed = false;

    SceneLoader sceneLoader;

    //Player interacts with pink square
    public void PinkIsInteracted()
    {
        pinkIsInteracted = true;
        if(pinkIsInteracted && blueIsInteracted)
        {
            allIsInteracted = true;
            ShowNextDoorSprite();
        }
    }

    //Player interacts with blue square
    public void BlueIsInteracted()
    {
        blueIsInteracted = true;
        if (pinkIsInteracted && blueIsInteracted)
        {
            allIsInteracted = true;
            ShowNextDoorSprite();
        }
    }

    //Player stopped interacting with blue square
    public void BlueStoppedInteracting()
    {
        blueIsInteracted = false;
        allIsInteracted = false;
    }

    //Player stopped interacting with pink square
    public void PinkStoppedInteracting()
    {
        pinkIsInteracted = false;
        allIsInteracted = false;
    }

    //If both squares are enabled at the same time, open door
    private void ShowNextDoorSprite()
```

```
    {
        if (!soundEffectHasPlayed)
        {
            AudioSource.PlayClipAtPoint(openDoorSFX, Camera.main.transform.position);
            soundEffectHasPlayed = true;
        }
        GetComponent<SpriteRenderer>().sprite = doorOpenOrClosed[1];
        forRealsiesAllInteracted = true;
    }

    //When interacted with the door, enable level progression
    private void OnTriggerEnter2D(Collider2D collision)
    {
        if (forRealsiesAllInteracted)
        {
            sceneLoader = FindObjectOfType<SceneLoader>();
            sceneLoader.LoadNextScene();
        }
    }

}
```

```
using System.Collections;
using System.Collections.Generic;
using UnityEngine;
using UnityEngine.SceneManagement;

public class OpenOrCloseDoor : MonoBehaviour
{
    [SerializeField] Sprite [] doorOpenOrClosed;
    [SerializeField] float LevelLoadDelay = 2f;
    [SerializeField] AudioClip openDoorSFX;

    SceneLoader sceneLoader;

    private void ShowNextDoorSprite()
    {
        GetComponent<SpriteRenderer>().sprite = doorOpenOrClosed[1];
    }

    //When something collides with the door, open the door and enable level
progression
    void OnTriggerEnter2D(Collider2D collider)
    {
        ShowNextDoorSprite();
        sceneLoader = FindObjectOfType<SceneLoader>();
        AudioSource.PlayClipAtPoint(openDoorSFX, Camera.main.transform.position);
        sceneLoader.LoadNextScene();

    }
}
```

```
using System.Collections;
using System.Collections.Generic;
using UnityEngine;
```

```
using UnityEngine.SceneManagement;

public class SquaresAndStethosExit : MonoBehaviour
{
    [SerializeField] int pinkStethosToCollect;
    [SerializeField] int blueStethosToCollect;
    [SerializeField] bool allPinkStethosCollected = false;
    [SerializeField] bool allBlueStethosCollected = false;
    [SerializeField] bool allStethosCollected = false;
    [SerializeField] Sprite[] doorOpenOrClosed;
    [SerializeField] bool pinkIsInteracted = false;
    [SerializeField] bool blueIsInteracted = false;
    [SerializeField] bool allIsInteracted = false;
    [SerializeField] bool keepInteractionAsTrue = false;
    [SerializeField] AudioClip openDoorSFX;


    SceneLoader sceneLoader;
    StethosScriptStethosAndSquares[] stethoscopeArray;
    StethosScriptStethosAndSquares stethosScriptStethosAndSquares;

    private void Start()
    {
        stethoscopeArray = FindObjectsOfType<StethosScriptStethosAndSquares>();
    }

    private void ShowNextDoorSprite()
    {
        GetComponent<SpriteRenderer>().sprite = doorOpenOrClosed[1];
        AudioSource.PlayClipAtPoint(openDoorSFX, Camera.main.transform.position);
    }

    private void ShowStethosIfSquareInteraction()
    {

        if (allIsInteracted)
        {
            foreach (StethosScriptStethosAndSquares stetho in stethoscopeArray)
            {
                stetho.ChangeSpritesToVisible();
            }
        }
        keepInteractionAsTrue = true;
    }

    //check door collider
    void OnTriggerEnter2D(Collider2D other)
    {
        //door will only open if all stethos are collected
        if (allStethosCollected && keepInteractionAsTrue)
        {
            sceneLoader = FindObjectOfType<SceneLoader>();
            sceneLoader.LoadNextScene();
        }
    }

    //keep track of begin amount of pink stethos
    public void CountPinkStethos()
    {
        pinkStethosToCollect++;
    }
```

```
    //keep track of begin amount of blue stethos
    public void CountBlueStethos()
    {
        blueStethosToCollect++;
    }

    //keep track of how many pink stethos are destroyed
    public void PinkStethosDestroyed()
    {
        pinkStethosToCollect--;
        //if there are no more pink stethos, all pink stethos are collected
        if (pinkStethosToCollect <= 0)
        {
            allPinkStethosCollected = true;
            if (allPinkStethosCollected && allBlueStethosCollected)
            {
                allStethosCollected = true;
                ShowNextDoorSprite();
            }
        }
    }

    //keep track of how many blue stethos are destroyed
    public void BlueStethosDestroyed()
    {
        blueStethosToCollect--;
        //if there are no more blue stethos, all blue stethos are collected
        if (blueStethosToCollect <= 0)
        {
            allBlueStethosCollected = true;
            if (allBlueStethosCollected && allPinkStethosCollected)
            {
                allStethosCollected = true;
                ShowNextDoorSprite();
            }
        }
    }

    //Player interacts with pink square
    public void PinkIsInteracted()
    {
        pinkIsInteracted = true;
        if (pinkIsInteracted && blueIsInteracted)
        {
            allIsInteracted = true;
            ShowStethosIfSquareInteraction();
        }
    }

    //Player interacts with blue square
    public void BlueIsInteracted()
    {
        blueIsInteracted = true;
        if (pinkIsInteracted && blueIsInteracted)
        {
            allIsInteracted = true;
            ShowStethosIfSquareInteraction();
        }
    }

    //Player stopped interacting with blue square
    public void BlueStoppedInteracting()
```

```
    {
        blueIsInteracted = false;
        allIsInteracted = false;
    }

    //Player stopped interacting with pink square
    public void PinkStoppedInteracting()
    {
        pinkIsInteracted = false;
        allIsInteracted = false;
    }
}
```